COMPARATIVE STUDY OF INTERNAL SPHINCTEROTOMY AGAINST MAXIMAL ANAL DILATATION IN POST OPERATIVE PAIN AFTER MILLIGAN MORGAN HAEMORRHOIDECTOMY

Dissertation submitted in partial fulfillment of regulation for the award of M.S. Degree in General Surgery (Branch I)

The TamilNadu

Dr. M.G.R. Medical University

December , 2011

Certificate

Certified that this is the bonafide dissertation done by

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DECLARATION

I solemnly declare that the dissertation titled

"COMPARATIVE STUDY OF INTERNAL SPHINCTEROTOMY AGAINST MAXIMAL ANAL DILATATION IN POST OPERATIVE PAIN AFTER MILLIGAN MORGAN HAEMORRHOIDECTOMY"

was done by me from May 2009 to October 2011 under the guidance and supervision of Professor **Dr. P. Swaminathan. D.O, M.S.,**

This dissertation is submitted to the Tamil Nadu Dr. MGR Medical University towards the partial fulfillment of the requirement for the award of MS Degree in General Surgery (Branch I).

Dr. SARVAJIT PRIYADARSHI BILIGERE

Place: Coimbatore

Date: 05.12.2011

ACKNOWLEDGMENT

I thank the Lord Almighty for blessing me with the wonderful life that i have.

I am grateful to Dr. Vimala M.D., Dean, Coimbatore Medical College, for providing me resources to complete my dissertation.

I am forever indebted to Prof. Dr. P.V.Vasantha Kumar M.S., Professor and Head, Department of General Surgery, Coimbatore Medical College, for his invaluable guidance and support through my post graduate course.

I express my deepest gratitude to Prof.Dr.P.Swaminathan D.O, M.S., for his valuable guidance and sincere interest in conducting this study.

I would like to thank my Assistant Professors Dr.P.Ramalingam M.S., Dr.Murugesan M.S and Dr.Tamil Selvan M.S., the Surgical Registrar for their suggestions and support.

I would like to thank all the faculty and staff members of Department of General Surgery for their cooperation and help.

For lending their emotional support, I am eternally grateful to my parents and other family members.

Above all, I would like to express my heartfelt gratitude to all the patients , for their participation and ineffable cooperation during this study.

LIST OF ABBREVIATIONS USED

(in alphabetical order)

Anal Transition Zone - ATZ

Excisional Haemorrhoidectomy - EH

Lateral Internal Sphincterotomy - LIS

Maximal Anal Dilatation - MAD

Milligan Morgan Haemorrhoidectomy - MMH

Rubber Band Ligation - RBL

Visual Analog Scale - VAS

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1. INTRODUCTION

Haemorrhoids are one of the most frequent anorectal disorders to affect humans. They are the most common cause of bleeding per rectum and cause considerable pain and suffering. The word haemorrhoid is derived from ancient Greek (haema = blood and rhoos =flowing).

The past decade has provided new treatment for haemorrhoids such as the stapled haemorrhoidopexy (stapled anopexy), which is now resulting in large numbers of scientific publications. Other new treatment options such as haemorrhoid arterial ligation and the transanal haemorrhoidal de-arterialisation are gaining in popularity, but the scientific evidence is not yet produced.

There are several hypotheses on the aetiology and there are several theories about the pathogenesis of haemorrhoids. The treatment result is often worse than usually stated in the literature with many patients complaining of persistent symptoms and disturbed continence after surgery ***(1-4)***.

Surgery is considered to be the best therapeutic modality for grade 3 and 4 haemorrhoids ***(5).*** Treatment options for haemorrhoids include - less invasive techniques like rubber band ligation(RBL) and the more radical excisional haemorrhoidectomy(EH) which are more painful. Superiority of EH over RBL was reported for grade 3 haemorrhoids ***(6)***. Over the years different surgical techniques have been described to reduce post operative pain.

The procedure known as excision and ligation, also called open haemorrhoidectomy, was originated by Frederick Salmon, the founder of St. Mark's Hospital, London, in the 1830s ***(7)***. Milligan et al. popularized and modified the technique, which is widely used in the United Kingdom as well as throughout the world ***(8-10)***. This

traditional approach is effective; however, it often is accompanied by a high incidence of complications, such as urinary retention, haemorrhage, and significant pain ***(11)***.

Internal sphincterotomy after a Milligan Morgan Haemorrhoidectomy reduces significantly pain in the first post operative period ***(12).*** High anal pressures are common in patients with haemorrhoids suggesting that they may have a pathogenetic role. Internal Sphincterotomy avoids pain, urinary retention and stenosis and is safe ***(13).***

Maximal Anal Dilatation was a technique described by Lord in 1968, which was based on careful but firm dilatation of the anal canal in order to reduce the anal canal pressure for management of haemorrhoids ***(14)*** .

This study was conducted to compare the post operative pain in two groups of patients treated with Lateral Internal Sphincterotomy and Maximal Anal Dilatation following a Milligan Morgan Haemorrhoidectomy.

2. OBJECTIVES

To assess and compare the outcomes of Maximal Anal Dilatation against Internal sphincterotomy following a Milligan-Morgan Haemorrhoidectomy in terms of Post operative pain.

3. REVIEW OF LITERATURE

Haemorrhoid is a hypertrophy of the normal anal cushions lying in the upper part of the anal canal. Anal cushions comprise of a thick sub mucosa which contains blood vessels, smooth muscle, elastic and connective tissue. The blood supply comes from the middle and inferior rectal arteries ***(15)***. These anal cushions are apposed in a way to ensure a precise closure of the anal canal. The word "*haemorrhoid"* is an old one. The origin of the word comes from the Greek haema or blood and rhoos or flowing. It was first used as a medical description by Hippocrates in 460 BC. The term "piles", derived from the Latin pila or ball, was widely used as early as 1370 AD. ***(16)***

The Egyptians

The earliest record of haemorrhoids comes from Egyptian Papyrus dated at 1700 BC. The document recorded the first treatment for pile, an herbal poultice: "if thou inspecteth a man in his anus, whether standing or sitting, suffering very greatly with seizures in both his legs. Thou shouldst give a recipe, an ointment of great protection; Acacia leaves, ground, titurated and cooked together. Smear a strip of fine linen therewith and place in the anus, that he may recover immediately." ***(16)***

The Greeks

Hippocrates wrote some of the earliest medical descriptions of haemorrhoids. The Hippocratic Treatises, written in 460 BC, described haemorrhoids as being caused by "bile or phlegm be determined to the veins of the rectum, it heats the blood in the veins; and being gorged the inside of the gut swells outwardly, and the heads of the veins are raised up, and being at the same time bruised by the faeces passing out, and

injured by the blood collected in them, they squirt out blood, most frequently along with the faeces." ***(16) Hippocrates*** also wrote of a haemorrhoid treatment similar to today's rubber band ligation procedure. He wrote "And haemorrhoids in like manner you may treat by transfixing them with a needle and tying them with very thick and woollen thread; for thus the cure will be more certain. When you have secured them, use a septic application, and do not foment until they drop off, and always leave one behind; and when the patient recovers let him be put on a course of Hellebore." ***(16)***

The Romans

In a medical treatise De Medicina, a Roman physician named Celcus (25 BC – AD 14) described the ligation and excision surgeries, as well as possible complications. Another description of hemorrhoids was provided by Galen (AD 131 – 201), who also promoted the use of severing the connection of the arteries to veins in order to reduce pain and avoid spreading gangrene. ***(16)***

The Far East

Haemorrhoid is not limited to the Western world – it is acknowledged as a disease in India by the Susruta Samhita, an ancient Sanskrit text dated between the fourth and fifth century AD. The description in this text is comparable to the Hippocratic Treatise, but with advancement in surgical procedures and emphasis on wound cleanliness. ***(16)***

The Master & Barber Surgeons

By the 13th century, there is a lot of progress in the surgical procedures, led by European physicians called the Master Surgeons. Renowned figures such as

Lanfrank of Milan, Guy de Chauliac, Henri de Mondeville, and John of Ardene greatly expanded and refined surgical procedures ***(16).***

The Renaissance

During the Renaissance, surgeries returned the realm of the scientists. A celebrated physician, Lorenz Heister, wrote about the crudeness of past procedures to treat haemorrhoids, and described a detailed procedure for ligation: "he is then to tie up the bleeding tunercles with a needle and thread, cutting off those parts which are distended beyond the ligature, taking care at the same time to leave a few of the smallest veins open as before observed." ***(16).***

The Eighteenth / Nineteenth Century

In 1774, Jean Louis Petit wrote a three-volume treatise on surgery, in which he noted that the skin of the anus is very sensitive. He reasoned that excision surgery alone should be avoided due to the pain and the possibly fatal complication of haemorrhage, whereas ligation procedure alone should not be performed because of the pain and the possibility of gangrene.

However, other physicians such as Brodie, disagreed with Petit's concern on ligation, noting that "the application of ligature to internal piles in general causes little pain, and only a slight degree of inflammation follows, for the mucous membrane has nothing like the sensibility of the skin, and does not resent an injury in like manner." Sir Astley Cooper also supported ligation after complications from haemorrhoid excision surgeries claimed three of his patients' lives.

During the nineteenth century, another treatment for haemorrhoids called anal stretching or rectal bouginage, became popular. In this treatment, a bougin – a cylindrical medical device used to stretch muscles and tissues, is inserted in the anal canal to enlarge the rectum as well as to "relax" the sphincter muscle and diminish haemorrhoids.

In 1888, Frederick Salmon, the founder of St. Marks Hospital, expanded the surgical procedure of haemorrhoid surgeries into a combination of excision and ligation. In this technique, the perianal skin is incised, the haemorrhoidal plexus and the anal muscles are dissected, and the haemorrhoid is ligated. ***(16)***

The Twentieth Century

So successful is Salmon's excision/ligation surgery that it remained virtually unchanged since its introduction in late nineteenth century. Even today's ***Ferguson*** and ***Milligan Morgan haemorrhoidectomy*** – considered the gold standards in haemorrhoid surgery – was a modification on Salmon's techniques. In late twentieth century, three further developments were introduced: the diathermy haemorrhoidectomy by Alexander Williams, rubber band ligation by Baron, and the stapled haemorrhoidectomy or Procedure for Prolapse and Haemorrhoids (PPH) by Longo. ***(16)***

Embryology of Anal Canal

The hindgut gives rise to the distal third of the transverse colon, the descending colon, the sigmoid, the rectum, and the upper part of the anal canal.

The distal part of the surgical anal canal is not related embryologically to the hindgut. It most likely originates from the anal pit, which is of ectodermal origin.

The terminal portion of the hindgut enters into the posterior region of the cloaca, the primitive **anorectal canal;** the allantois enters into the anterior portion, the primitive **urogenital sinus**. The cloaca itself is an endoderm-lined cavity covered at its ventral boundary by surface ectoderm. This boundary between the endoderm and the ectoderm forms the **cloacal membrane**(proctodeum).

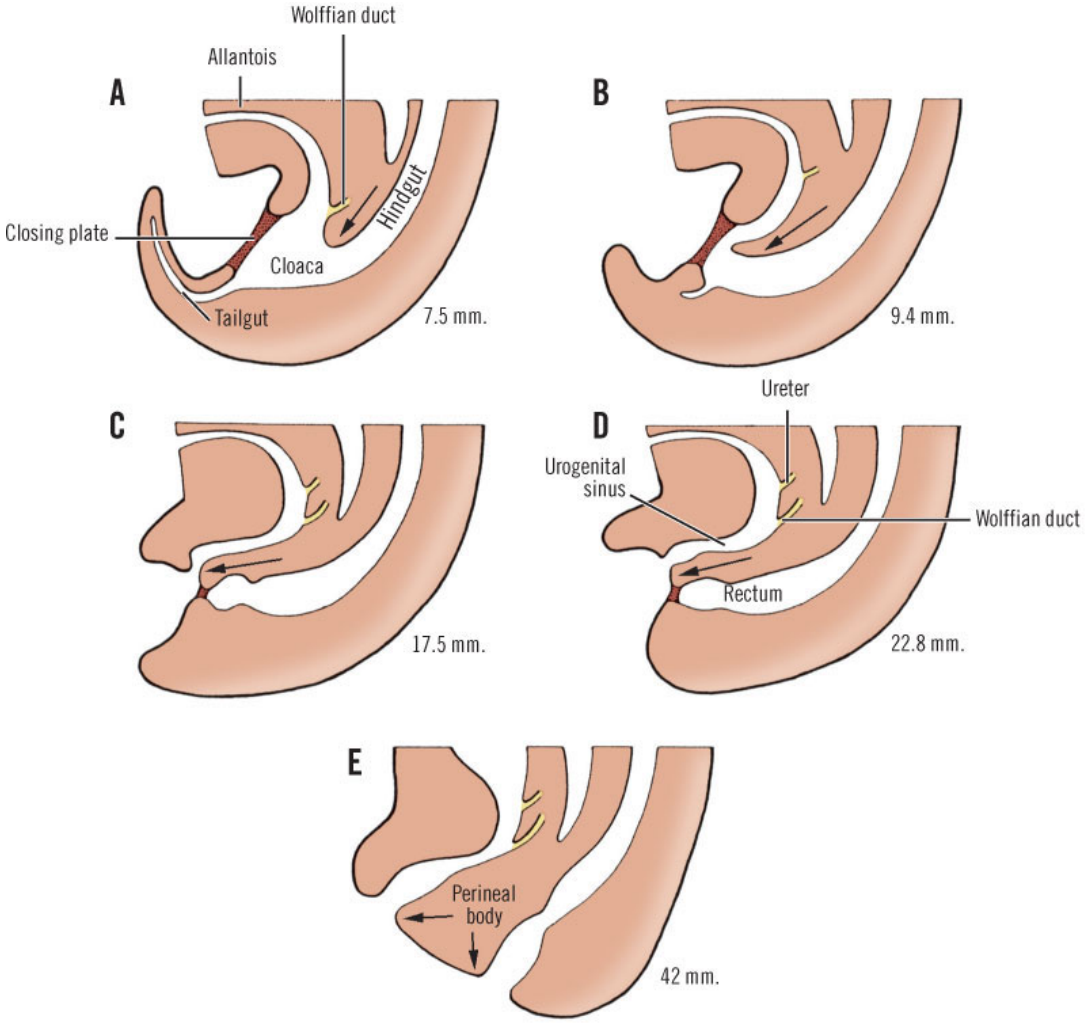
A layer of mesoderm, the **urorectal septum,** separates the region between the allantois and hindgut. This septum is derived from the merging of mesoderm covering the yolk sac and surrounding the allantois. As the embryo grows and caudal folding continues, the tip of the urorectal septum comes to lie close to the cloacal membrane, although the two structures never make contact.

At the end of the seventh week, the cloacal membrane ruptures, creating the anal opening for the hindgut and a ventral opening for the urogenital sinus. Between the two, the tip of the urorectal septum forms the perineal body. At this time, proliferation of ectoderm closes the caudal most region of the anal canal.

During the ninth week, this region recanalizes. Thus, the caudal part of the anal canal originates in the ectoderm, and it is supplied by the **inferior rectal arteries,** branches of the **internal pudendal arteries.**

The cranial part of the anal canal originates in the endoderm and is supplied by **the superior rectal artery,** a continuation of the **inferior mesenteric artery,** the artery of the hindgut.

The junction between the endodermal and ectodermal regions of the anal canal is delineated by the **pectinate line,** just below the anal columns. At this line, the epithelium changes from columnar to stratified squamous epithelium.



(FIGURE 1)Diagram of stages in development of the anus and rectum from the fifth to tenth weeks of gestation. (*Skandalakis, 2004)*

A, Closing plate (proctodeum separates the cloaca from the outside). Urorectal septum *(arrow)* grows downward to divide the cloaca.
B, Cloaca almost separated into dorsal rectum and ventral urogenital sinus. Tailgut is vanishing.
C, Fusion of urorectal septum with closing plate to form the perineal body.
D, Closing plates rupture.
E, Division into rectum and urogenital sinus by the perineal body is complete.

Anatomy of the Anal canal

The anal canal is the terminal portion of the intestinal tract. It begins at the anorectal junction (the point passing through the levator ani muscles), is about 4 cm long, and terminates at the anal verge.

This definition differs from that of the anatomist, who designates the anal canal as the part of the intestinal tract that extends from the dentate line to the anal verge.

The anal canal is surrounded by strong muscles, and because of tonic contraction of these muscles, it is completely collapsed and represents an anteroposterior slit.

The musculature of the anorectal region may be regarded as two tubes, one surrounding the other. The inner tube, being visceral, is smooth muscle and is innervated by the autonomic nervous system, while the outer funnel-shaped tube is skeletal muscle and has somatic innervation. This short segment of the intestinal tract is of paramount importance because it is essential to the mechanism of fecal continence and also because it is prone to many diseases.

The anatomy of the anal canal and perianal structures has been imaged using endoluminal magnetic resonance imaging. The lateral canal is significantly longer than its anterior and posterior part.

The anterior external anal sphincter is shorter in women than in men and occupies, respectively, 30% and 38% of the anal canal length.

The median length and thickness of the female anterior external anal sphincter are 11 and 13mm, respectively.

The caudal ends of the external anal sphincter forms a double layer. The perineal body is thicker in women than in men and easier to define.

The superficial transverse muscles have a lateral and caudal extension to the ischiopubic bones.

The bulbospongiosus is thicker in men than in women. The ischiocavernosus and anococcygeal body have the same dimensions in both sexes.

RELATIONS

Posteriorly the anal canal is related to its surrounding muscle, the anococcygeal ligament and the coccyx.

Laterally are the ischiorectal fossae with its inferior rectal vessels and nerves.

Anteriorly in the male is the urethra. Anteriorly in the female are the perineal body and the lowest part of the posterior vaginal wall.

LINING OF THE ANAL CANAL

The lining of the anal canal consists of epithelium of different types at different levels. At approximately the midpoint of the anal canal there is an undulating demarcation referred to as the ***dentate line***. This line is approximately 2 cm from the anal verge. Because the rectum narrows into the anal canal, the tissue above the dentate line takes on a pleated appearance.

These longitudinal folds, of which there are 6 to 14, are known as the ***Columns of Morgagni***. There is a small pocket or crypt at the lower end of and between adjacent columns of the folds. These crypts are of surgical significance because foreign material may become lodged in them, obstructing the ducts of the anal glands and possibly resulting in sepsis.

The mucosa of the upper anal canal is lined by columnar epithelium. Below the dentate line the anal canal is lined with a squamous epithelium. The change, however, is not abrupt. For a distance of 6–12mm above the dentate line there is a gradual transition where columnar, transitional, or squamous epithelium may be

found. This area, referred to as the ***anal transitional or cloacogenic zone,*** has extremely variable histology. ***(17)***

A colour change in the epithelium is also noted. The rectal mucosa is pink, whereas the area just above the dentate line is deep purple or plum color due to the underlying internal haemorrhoidal plexus. Subepithelial tissue is loosely attached to and radially distensible from the internal haemorrhoidal plexus. Subepithelial tissue at the anal margin, which contains the external haemorrhoidal plexus, forms a lining that adheres firmly to the underlying tissue.

At the level of the dentate line, the lining is anchored by the ***mucosal suspensory ligament***. The perianal space is limited above by this ligament and below by the attachment of the longitudinal muscle to the skin of the anal verge.

The area below the dentate line is not true skin because it is devoid of accessory skin structures (e.g., hair, sebaceous glands, and sweat glands). This pale, delicate, smooth, thin, and shiny stretched tissue is referred to as ***anoderm*** and runs for approximately 1.5 cm below the dentate line. At the anal verge the lining becomes thicker and pigmented and acquires hair follicles, glands, and other histologic features of normal skin. In this circumanal area there is also a well-marked ring of apocrine glands, which may be the source of the clinical condition called hidradenitis suppurativa.

Proximal to the dentate line the epithelium is supplied by the autonomic nervous system, while distally the lining is richly innervated by the somatic nervous system ***(17)***

ANAL TRANSITIONAL ZONE

The anal transitional zone (ATZ) is interposed between uninterrupted colorectal type mucosa (columnar) above and uninterrupted squamous epithelium (anoderm) below, irrespective of the type of epithelium present in the zone itself.

The ATZ usually commences just above the dentate line and is much smaller than commonly thought. The histology of the ATZ is extremely variable. Most of the zone is covered by ATZ epithelium, which appears to be composed of four to nine cell layers—the basal cells, columnar, cuboidal, unkeratinized squamous epithelium, and anal glands. The ATZ epithelium contains a mixture of sulphomucin and sialomucin. The mucin pattern in the columnar variant of the ATZ epithelium and in the anal canal is of the same type and differs from that of colorectal- type epithelium. Histochemical study shows that endocrine cells have been demonstrated in 87% of specimens. Their function is unknown. Melanin is found in the basal layer of the ATZ epithelium in 14% of specimens. Melanin cannot be demonstrated in the anal gland but is a constant finding in the squamous epithelium below the dentate line, increasing in amount as the perianal skin is approached. The melanincontaining cells in the ATZ seem a reasonable point of origin for melanoma, as do the findings of junctional activity and atypical melanocyte hyperplasia in the ATZ. ***(17)***

ANAL GLANDS

The average number of glands in a normal anal canal is six (range, 3–10). Each gland is lined by stratified columnar epithelium with mucus-secreting or goblet cells interspersed within the glandular epithelial lining and has a direct opening into an anal crypt ***(Crypt of Morgagni)*** at the dentate line. Occasionally, two glands open into the same crypt, while half the crypts have no communication with the glands.

These glands were first described by Chiari in 1878 . The importance of their role in the pathogenesis of fistulous abscess was presented by Parks in 1961. (***17)***

Seow-Choen and Ho find that 80% of the anal glands are submucosal in extent, 8% extend to the internal sphincter, 8% to the conjoined longitudinal muscle, 2% to intersphincteric space, and 1% penetrate the external sphincter. The anal glands are fairly evenly distributed around the anal canal, although the greatest number are found at the anterior quadrant. Mild to moderate lymphocytic infiltration is noted around the anal glands and ducts; this is sometimes referred to as ***''anal tonsil.'' (17)***

DENTATE LINE

It is the most important landmark both morphologically and surgically. It represents the site of fusion of the proctodeum and the post allantoic gut, and the position of the anal membrane, remnants of which may be frequently seen as anal papillae situated on the free margin of the anal valves. The dentate line separates -

Above :

- cubical epithelium
- autonomic nerves (insensitive)
- portal venous system

Below :

- from squamous epithelium
- from spinal nerves (sensitive)
- from systemic venous system

ANATOMICAL AND SURGICAL IMPORTANCE OF DENTATE LINE :

1) It forms the embryological watershed between visceral structures above and somatic structures below the line.

2) The mucosa above the line has an autonomic nerve supply and hence is insensitive, whereas the skin below is supplied by the Inferior rectal branch of the Pudendal nerve and is pain sensitive.

3) The venous drainage of the mucosa above is into the Inferior mesenteric and portal circulation, whereas, of the skin below is into the systemic venous circulation.

4) The lymphatic drainage above the dentate line is into the Internal iliac nodes, while, below is into the Inguinal nodes.

ANORECTAL SPACES

PERIANAL SPACE

The perianal space is in the immediate area of the anal verge surrounding the anal canal. Laterally it becomes continuous with the subcutaneous fat of the buttocks or may be confined by the conjoined longitudinal muscle.

Medially it extends into the lower part of the anal canal as far as the dentate line. It is continuous with the intersphincteric space.

The perianal space contains the lowest part of the external sphincter, the external hemorrhoidal plexus, branches of the inferior rectal vessels, and lymphatics.

The radiating elastic septa divide the space into a compact honeycomb arrangement, which accounts for the severe pain produced by a collection of pus or blood.

ISCHIOANAL SPACE

The ischioanal fossa is a pyramid-shaped space. The apex is formed at the origin of the levator ani from the obturator fascia, and the inferior boundary is the skin on the perineum.

The anterior boundary is formed by the superficial and deep transverse perineal muscles and the posterior boundary of the perineal membrane. The posterior boundary is the gluteal skin. The medial wall is composed of the levator ani and the external sphincter muscles.

The lateral wall is nearly vertical and is formed by the obturator internus muscle and the ischium and by the obturator fascia.

The base or inferior boundary is the transverse septum, which divides this space from the perianal space.

In the obturator fascia, on the lateral wall, is the Alcock's canal, which contains the internal pudendal vessels and the pudendal nerve. When the ischioanal and perianal spaces are regarded as a single tissue space, it is called the **Ischioanal fossa**. The contents of the ischioanal fossa consist of a pad of fat, the inferior rectal nerve coursing from the back of the ischioanal fossa forward and medially to the external sphincter, the inferior rectal vessels, portions of the scrotal nerves and vessels in men and the labial nerves and vessels in women, the transverse perineal vessels, and the perineal branch of the fourth sacral nerve running to the external sphincter from the posterior angle of the fossa.

Anteriorly the ischioanal space has an important extension forward, above the urogenital diaphragm, which may become filled with pus in cases of ischioanal abscesses.

INTERSPHINCTERIC SPACE

The intersphincteric space lies between the internal and external sphincter muscles, is continuous below with the perianal space, and extends above into the wall of the rectum.

SUPRALEVATOR SPACE

Situated on each side of the rectum is the supralevator space, bounded superiorly by the peritoneum, laterally by the pelvic wall, medially by the rectum, and inferiorly by the levator ani muscle. Sepsis in this area may occur because of upward extension of anoglandular origin or from a pelvic origin.

SUBMUCOUS SPACE

Between the internal sphincter and the mucosa lies the submucous space. It extends distally to the dentate line and proximally becomes continuous with the submucosa of the rectum. It contains the internal haemorrhoidal plexus. Although abscesses in this space have been described, they are probably of little clinical significance and have been mistaken for what, in fact, were intersphincteric abscesses.

SUPERFICIAL POSTANAL SPACE

The superficial postanal space connects the perianal spaces with each other posteriorly below the anococcygeal ligament.

DEEP POSTANAL SPACE

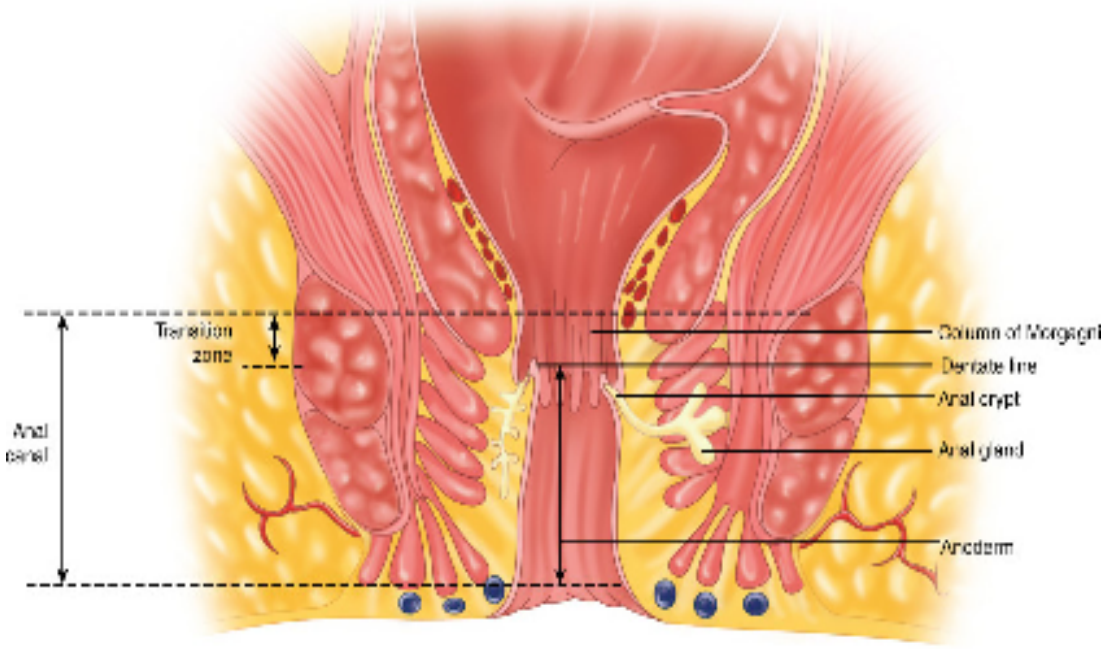
The right and left ischioanal spaces are continuous posteriorly above the anococcygeal ligament but below the levator ani muscle through the deep postanal

space also known as the ***Retrosphincteric space of Courtney.*** This postanal space is the usual pathway by which purulent infection spreads from one ischioanal space to the other, which results in the so-called horseshoe abscess**.**

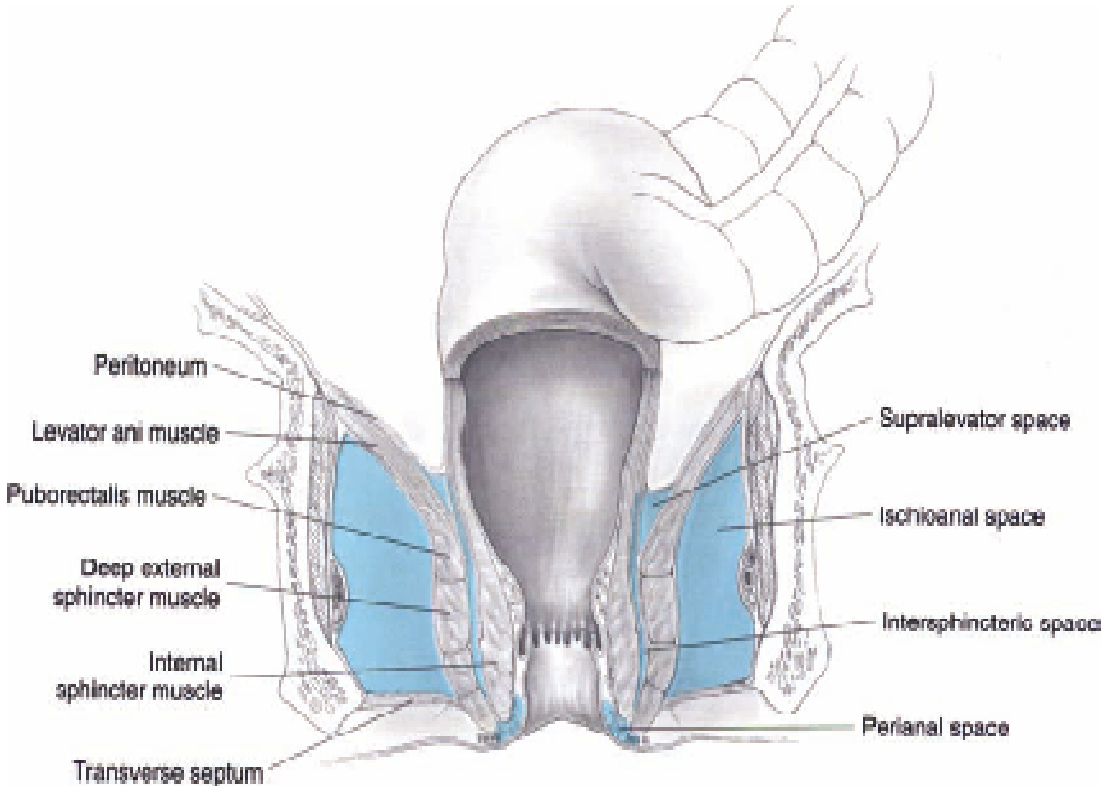
RETRORECTAL SPACE

The retrorectal space lies between the upper two-thirds of the rectum and sacrum above the rectosacral fascia. It is limited anteriorly by the fascia propria covering the rectum, posteriorly by the presacral fascia, and laterally by the lateral ligaments (stalks) of the rectum. Superiorly it communicates with the retroperitoneal space, and inferiorly it is limited by the rectosacral fascia, which passes forward from the S4 vertebra to the rectum, 3–5cm proximal to the anorectal junction. Below the rectosacral fascia is the supralevator space, a horseshoe-shaped potential space, limited anteriorly by the fascia propria of the rectum and below by the levator ani muscle. The retrorectal space contains loose connective tissue. The presacral fascia protects the presacral vessels that lie deep to it. The presacral veins are part of the extensive vertebral plexus and are responsible for the major bleeding problems encountered in this area during operation. In addition to the usual tissues from which neoplasms can arise, this is an area of embryologic fusion and remodeling; thus it is the site for persistence of embryologic remnants from which neoplasms also can arise.

The perianal, ischioanal, and supralevator spaces on each side connect posteriorly with their counterparts on the opposite side, forming a horseshoe-shaped communication.



(FIGURE 2) The lining of the anal canal. *(Schwartz, 9th edition)*



(FIGURE 3) Perianal and perirectal spaces (frontal view) *(Gordon, 2007)*

MUSCLES OF THE ANORECTAL REGION

INTERNAL SPHINCTER MUSCLE

The downward continuation of the circular, smooth muscle of the rectum becomes thickened and rounded at its lower end and is called the internal sphincter. Its lowest portion is just above the lowest part of the external sphincter and is 1–1.5 cm below the dentate line.

CONJOINED LONGITUDINAL MUSCLE

At the level of the anorectal ring, the longitudinal muscle coat of the rectum is joined by fibers of the levator ani and puborectalis muscles. Another contributing source is the pelvic fascia. The conjoined longitudinal muscle so formed descends between the internal and external anal sphincters. Many of these fibers traverse the lower portion of the external sphincter to gain insertion in the perianal skin and are referred to as the corrugator cutis ani. In a review of the anatomy and function of the anal longitudinal muscle, *Lunnis and Phillips* speculated that this muscle plays a role as a skeleton supporting and binding the internal and external sphincter complex together, as an aid during defecation by everting the anus, as a support to the haemorrhoidal cushions, and as a determining factor in the ramification of sepsis***(17).***

EXTERNAL SPHINCTER MUSCLE

This elliptical cylinder of skeletal muscle that surrounds the anal canal was originally described as consisting of three distinct divisions: the subcutaneous, superficial, and deep portions.

This account was shown to be invalid by *Goligher*, who demonstrated that a sheet of muscle runs continuously upward with the puborectalis and levator ani muscles. ***(17)*** The lowest portion of the external sphincter occupies a position below and slightly

lateral to the internal sphincter. A palpable groove at this level has been referred to as the **intersphincteric groove**. The lowest part (subcutaneous fibers) is traversed by the conjoined longitudinal muscle, with some fibers gaining attachment to the skin. The next portion (superficial) is attached to the coccyx by a posterior extension of muscle fibers that combine with connective tissue, forming the **anococcygeal ligament**. Above this level, the deep portion of the external sphincter is devoid of posterior attachment and proximally becomes continuous with the puborectalis muscle. Anteriorly, the high fibers of the external sphincter are inserted into the perineal body, where some merge and are continuous with the transverse perineal muscles. The female sphincter has a variable natural defect occurring along its anterior length.

The external sphincter is supplied by the inferior rectal nerve and a perineal branch of the fourth sacral nerve.

PERINEAL BODY

The perineal body is the anatomic location in the central portion of the perineum where the external sphincter, bulbocavernosus, and superficial and deep transverse perineal muscles meet. This tends to be a tendinous intersection and is believed to give support to the perineum and to separate the anus from the vagina.

PELVIC FLOOR MUSCLES

The levator ani muscle is a broad, thin muscle that forms the greater part of the floor of the pelvic cavity and is innervated by the fourth sacral nerve. This muscle traditionally has been considered to consist of three muscles:

The iliococcygeus, the pubococcygeus, and the puborectalis.

Puborectalis Muscle

The puborectalis muscle arises from the back of the symphysis pubis and the superior fascia of the urogenital diaphragm, runs backward alongside the anorectal junction, and joins its fellow muscle of the other side immediately behind the rectum, where they form a U-shaped loop that slings the rectum to the pubes.

Iliococcygeus Muscle

The iliococcygeus muscle arises from the ischial spine and posterior part of the obturator fascia, passes downward, backward, and medially, and becomes inserted on the last two segments of the sacrum, the coccyx, and the anococcygeal raphe. There are no connections to the anal canal.

Pubococcygeus Muscle

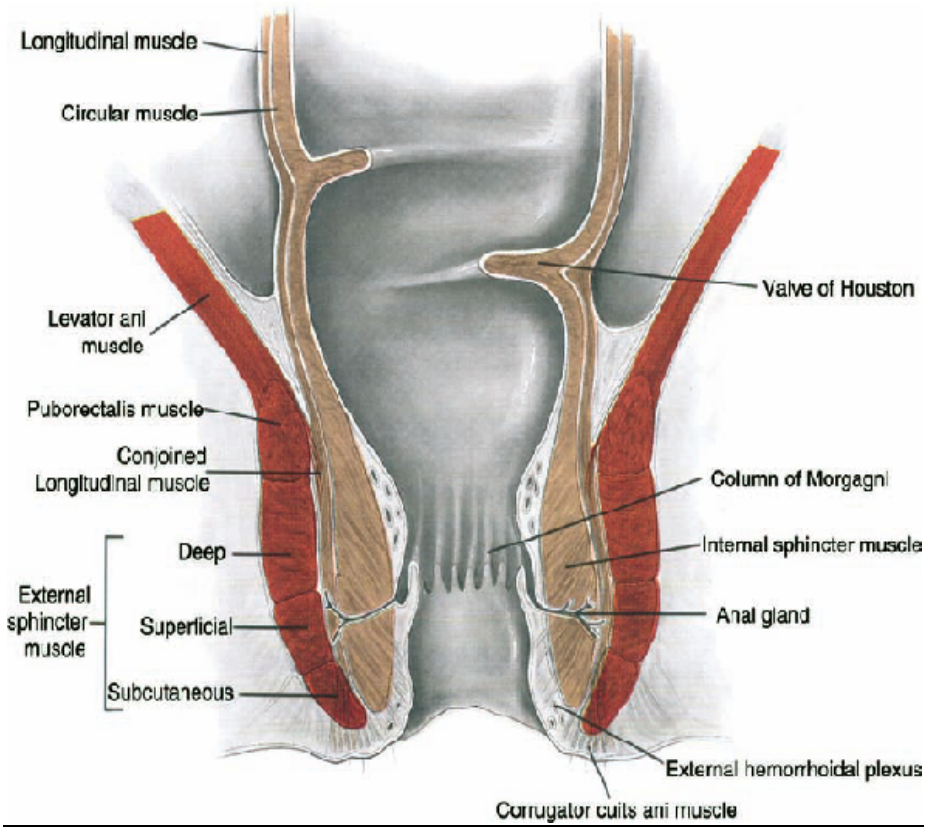
The pubococcygeus muscle arises from the anterior half of the obturator fascia and the back of the pubis. Its fibers are directed backward, downward, and medially where they decussate with fibers of the opposite side. This line of decussation is called the anococcygeal raphe.

Some fibers, which lie more posteriorly, are attached directly to the tip of the coccyx and the last segment of the sacrum. This muscle also sends fibers to share the formation of the conjoined longitudinal muscle. The muscle fibers of the pubococcygeus, while proceeding backward, downward, and medially, form an elliptical space, called the **‘‘levator hiatus’’**through which pass the lower part of the rectum and either the prostatic urethra and dorsal vein of the penis in men or the vagina and urethra in women. The intrahiatal viscera are bound together by part of the pelvic fascia, which is more condensed at the level of the anorectal junction and has been called the **‘‘hiatal ligament’’**. This ligament is believed to keep the movement of the intrahiatal structures in harmony with the levator ani muscle. The

crisscross arrangement of the anococcygeal raphe prevents the constrictor effect on the intrahiatal structures during levator ani contraction and causes a dilator effect. The puborectalis and the levator ani muscles have a reciprocal action. As one contracts, the other relaxes. During defecation there is puborectalis relaxation accompanied by levator ani contraction, which widens the hiatus and elevates the lower rectum and anal canal. When a person is in an upright position, the levator ani muscle supports the viscera. ***(17)***

ANORECTAL RING

''Anorectal ring'' is a term coined by Milligan and Morgan to denote the functionally important ring of muscle that surrounds the junction of the rectum and the anal canal. It is composed of the upper borders of the internal sphincter and the puborectalis muscle. It is of paramount importance during the treatment of abscesses and fistulas because division of this ring will inevitably result in anal incontinence. ***(17)***



(FIGURE 4) Anal canal. *(Gordon, 2007)*

INNERVATION OF THE ANAL CANAL

A. MOTOR SUPPLY :

1) Internal anal sphincter :

It is supplied by both sympathetic and parasympathetic fibres. Sympathetic fibres arise from the *pelvic plexus* and cause contraction of the sphincter. Parasympathetic enter from the *pelvic splanchnic nerves(S 2,3,4)* and cause relaxation of the sphincter.

2) External anal sphincter :

It is supplied by the inferior rectal branch of the internal pudendal nerve and the perineal branch of the fourth sacral nerve.

The pudendal nerve passes through the greater sciatic foramen and crosses the sacrospinous ligament accompanied by the internal pudendal artery and vein. The pudendal nerve lies on the lateral wall of the ischioanal fossa, where it gives off the inferior rectal nerve, which crosses the ischioanal fossa with the inferior rectal vessels to reach the external sphincter.

B. SENSORY SUPPLY :

The part of the anal canal above the dentate line is supplied by autonomic nerves (S 2,3) and hence, is insensitive to pain.

Below the dentate line. the anal canal is supplied by the Inferior Rectal nerve, a branch of the Pudendal nerve and is sensitive to pain.

The epithelium of the anal canal is profusely innervated with sensory nerve endings, especially in the vicinity of the dentate line.

ARTERIAL SUPPLY OF ANAL CANAL

The anal canal is supplied by the branches from *superior, middle and inferior rectal arteries*.

1) Superior rectal artery :

The inferior mesenteric artery proceeds downward, crossing the left common iliac artery and vein to the base of the sigmoid mesocolon to become the superior rectal artery.

The superior rectal artery starts at the last branch of the sigmoid artery. It lies posterior to the right of the sigmoid colon, coming in close contact with the posterior aspect of the bowel at the rectosigmoid junction. It forms a rectosigmoid branch, an upper rectal branch, and then divides into left and right terminal branches. The terminal branches extend downward and forward around the lower twothirds of the rectum to the level of the levator ani muscle.

Tortuous small branches ascend subperitoneally to the anterior aspect of the upper third of the rectum and anastomose with the upper rectal branch.

The rectosigmoid branch arises at the rectosigmoid junction and divides directly into two diverging branches. One ascends to the sigmoid colon and anastomoses with branches of the last sigmoid artery, and the other descends to the rectum and anastomoses with the upper rectal branch.

The upper rectal branch arises from the superior rectal artery before its bifurcation. It makes an extramural anastomosis with the lower branch of the rectosigmoid artery and the terminal branch of the superior rectal artery.

2)Middle rectal artery :

Middle rectal arteries arise from the internal pudendal arteries. Their terminal branches pierce the wall of the rectum at variable points but usually in the lower third of the rectum. The presence of the middle rectal artery can be anticipated if the diameter of the terminal branches of the superior rectal artery is smaller than usual. Conversely, when the middle rectal arteries are absent, the superior rectal artery has larger size than usual.

3)Inferior rectal artery :

The inferior rectal arteries, which are branches of the inferior iliac arteries, arise from the pudendal artery (in Alcock's canal). They traverse the ischioanal fossa and supply the anal canal and the external sphincter muscles. There is no extramural anastomosis between the inferior rectal arteries and other rectal arteries. However, arteriography demonstrates an abundance of anastomoses among the inferior and superior rectal arteries at deeper planes in the walls of the anal canal and rectum.

VENOUS DRAINAGE OF THE ANAL CANAL

The upper half is drained by the *superior rectal vein into the inferior mesenteric vein* and the lower half is drained by the *inferior rectal vein into the internal pudendal vein*.

The mucous membrane of the upper two thirds of the anal canal contains a rich plexus of veins. These drain upwards, by vertical channels, which when filled with blood raise ridges in the mucous membrane known as Anal columns. The veins pass upwards in the submucosa to join the submucous plexus in the rectal ampulla.

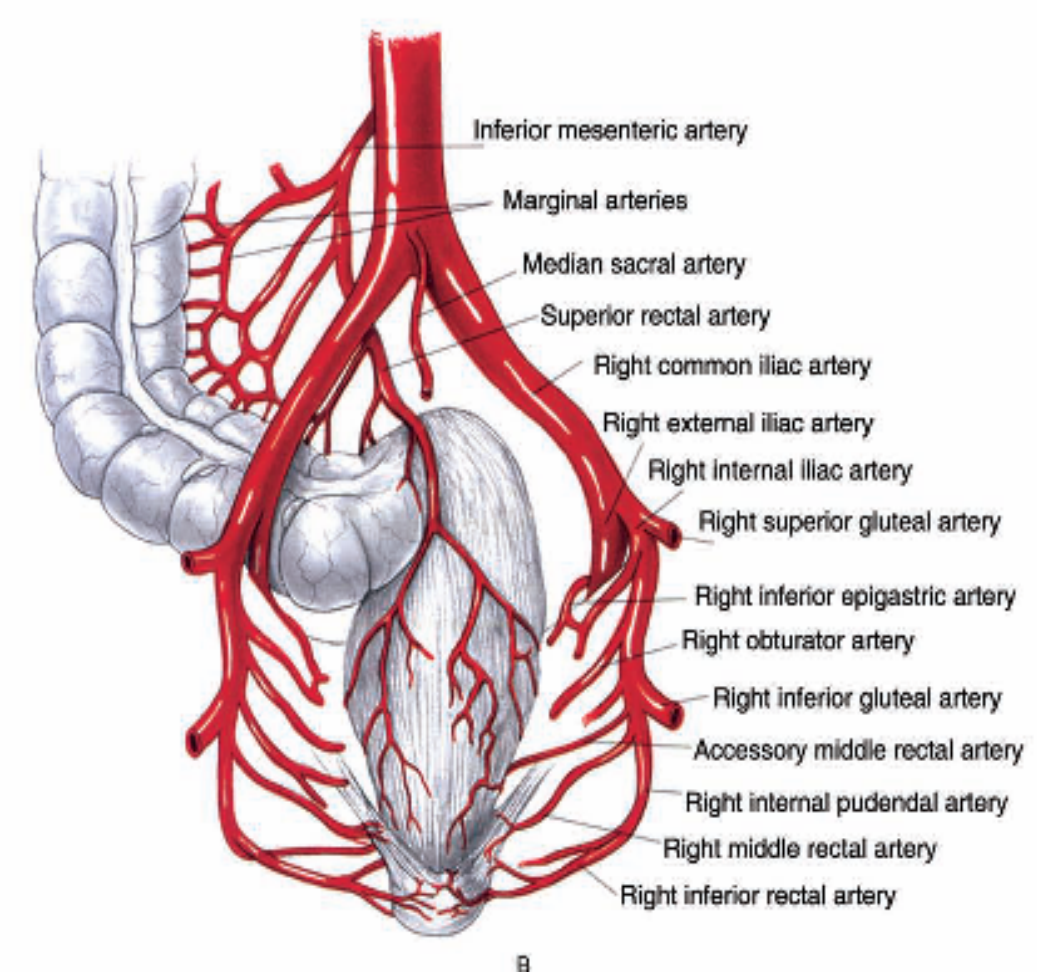
The anal columns are joined by cross anastomosing veins which raise small submucosal folds known as Anal valves. These anastomosing cross channels form a venous ring known as *Annulus haemorrhoidalis* or *Zona haemorrhoidalis* .

The anal columns vary in prominence according to the amount of blood contained in them. The anal valves remain constant irrespective of the amount of blood in the annulus. At the lower end of the anal columns, the tributary venous radicals show multiple dilatations which together with the thickenings of the corrugator cutis ani, make 3 anal cushions at 3, 7 & 11 o'clock positions when the patient is in the lithotomy position.

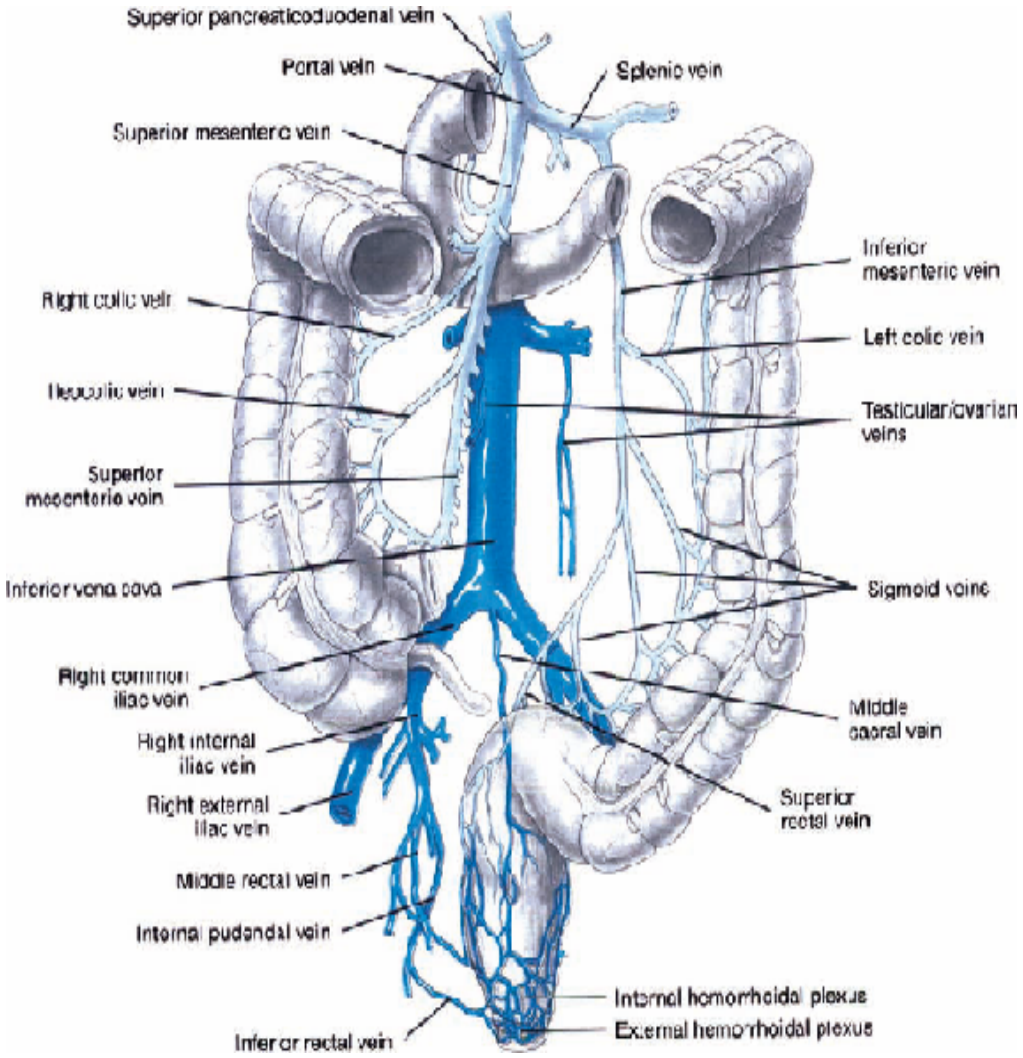
LYMPHATIC DRAINAGE OF THE ANAL CANAL

Lymphatics from the anal canal above the dentate line drain cephalad via the superior rectal lymphatics to the inferior mesenteric nodes and laterally along both the middle rectal vessels and the inferior rectal vessels through the ischioanal fossa to the internal iliac nodes.

Lymph from the anal canal below the dentate line usually drains to the inguinal nodes. It also can drain to the superior rectal lymph nodes or along the inferior rectal lymphatics through the ischioanal fossa if obstruction occurs in the primary drainage.



(FIGURE 5) Arterial supply. (A) Supply to the colon. (B) Supply to the rectum (posterior view) *(Gordon, 2007)*



(FIGURE 6) Venous drainage of the colon and rectum. (Dark blue represents systemic venous drainage. Light blue shows portal venous drainage.) (*Gordon, 2007)*

Physiology of the anal canal

The physiology of the anorectal region is very complex, and it is only recently that detailed investigations have given us a better understanding of its function.

ANAL CONTINENCE

It is defined as the ability to control defecation voluntarily, to sense the quality of rectal contents and to maintain nocturnal control.

Maintaining anal continence is a complex matter because it is controlled by local reflex mechanisms as well as by conscious will. Normal continence depends on a highly integrated series of complicated events.

Stool volume and consistency are important because patients who have weakened mechanisms may be continent for a firm stool but incontinent for liquid feces.

Also significant is the rate of delivery of feces into the rectum, which emphasizes the *reservoir function of the rectum*.

Other important factors include the *sphincteric component, sensory receptors, mechanical factors, and the corpus cavernosum of the anus*. ***(17)***

Stool Volume and Consistency

Stool weight and volume vary from individual to individual, from one time to another in a given individual, and from one geographic region to another. The frequency of passing stool may play some role in continence in that colonic transit time is rapid when the large bowel content is liquid because the left colon does not store fluid well.

Stool consistency probably is the most important physical characteristic influencing anal continence. The ability to maintain normal control may depend on whether the rectal contents are solid, liquid, or gas. Some patients may be continent for solid

stool but not for liquid or gas, or continent for stool but not for gas. This fact is important in the management of patients with anal incontinence because the manoeuvre of changing stool consistency from liquid into solid may be enough to allow the patient to recapture faecal control.

Reservoir Function of Rectum

The distal part of the large intestine has a reservoir function that is important in the maintenance of anal continence and depends on several factors.

First, the lateral angulations of the sigmoid colon and the valves of Houston provide a mechanical barrier and retard progression of stool ***(18)***. The weight of the stool tends to accentuate these angles and enhances their barrier effect ***(19).***

The adaptive compliance of the rectum along with rectal capacity and distensibility also are important factors for effective reservoir function.

Differences in pressure patterns between the distal and proximal levels of the anal canal result in the development of a force vector in the direction of the rectum. This continuous differential activity may be important in controlling the retention of small amounts of liquid matter and flatus in the rectum.

Furthermore, the angulation between the rectum and anal canal, which is due to the continuous tonic activity of the puborectalis muscle, as well as the high-pressure zone in the anal canal contribute to the reservoir function of the rectum.

Sphincteric Factors

Activity of the anal sphincters is generally believed to be the most important factor in maintaining anal continence. Within the anal canal, the sphincters are responsible for the *high-pressure zone*. The maximum anal resting pressure varies between 40

and 80mmHg ***(20)***and appears to provide a barrier against intrarectal pressure. The high pressure zone, as demonstrated by pull-through recordings, has an average length of 3.5 cm ***(21-23)***and results mainly from the continuous tonic activity of both sphincters. The major contribution to the high-pressure zone comes from the internal anal sphincter.

Continuous tonic activity at rest and even during sleep has been recorded in the pelvic floor muscles and in the external sphincter ***(24).*** Although activity is always present in the external sphincter, its basal tone shows considerable variations, determined by postural changes. For example, external sphincter activity will increase when an individual is in an upright position. The activity also is augmented by perianal stimulation (anal reflex) and by increases in intra-abdominal pressure, such as coughing, sneezing, and the Valsalva manoeuvre. Rectal distention with initial small volumes also will result in increased activity.

Rectal Sensory Perception

The conscious sensation of urgency is mediated by extrinsic afferent neurons. These neurons are activated by mechanoreceptors. Although it has been suggested that these receptors are located in the pelvic floor ***(25)***, there is growing evidence that the rectal wall itself contains many mechanoreceptors.

According to Ruhl et al. the sacral dorsal roots contain afferents from low-threshold mechanoreceptors located in the rectal wall. These afferents monitor the filling state and contraction level of the rectum ***(26).*** These receptors are very rare or absent more proximally in the colon ***(27).*** They do not act simply as tension and stretch receptors. They also detect mechanical deformation, such as flattening of myenteric ganglia.

Furthermore, they are able to encode the contractile activity of smooth muscle cells. Activation of the rectal mechanoreceptors induces extrinsic and intrinsic reflexes that play a key role in defecation.

Anal Sensory Perception

A more precise perception of the nature of the rectal content is achieved by sensory receptors within the anal canal. Careful histologic studies have demonstrated an abundance of free and organized nerve endings in the epithelium of the anal canal ***(28)***. Several types of sensory receptors have been identified: nerve endings that denote pain (free intraepithelial), touch (Meissner's corpuscles), cold (bulbs of Krause), pressure or tension (Pacini corpuscles and Golgi-Mazzoni corpuscles), and friction (genital corpuscles) ***(28).*** These nerve endings are located primarily in the distal half of the anal canal but may extend for 5–15mm above the dentate line. Pain can be felt as far as 1–1.5 cm above the anal valves; this corresponds with clinical experience, such as the application of rubber band ligation of haemorrhoids. The rectum is insensitive to stimuli other than stretch. Whether or not this sensory zone is important for anal continence remains controversial. ***(17)***

In a study in which a saline continence test was used, no effect could be demonstrated when the anal canal was anesthetized with lidocaine, leading the authors to conclude that anal canal sensation does not play a crucial role in continence ***(29).***

However, in a more recent study in which a technique to assess anorectal temperature sensation was used, it has been shown that very small changes in temperature can be detected in the anal canal. The lower and middle parts of the canal were found to be much more sensitive to temperature changes than was the

upper part ***(30).*** This finding supports the concept of the sampling response and reinforces the role of this sensory zone of the anal canal in maintaining continence.

Mechanical Factors

1) ANGULATION BETWEEN RECTUM AND ANAL CANAL

The most important component for the conservation of gross fecal continence is the angulation of the anorectal system. It is due to the continuous tonic activity of the puborectalis muscle.

As measured by defecography, the angle between the axis of the anal canal and the rectum in the resting state is about 90 degrees. Radiographic studies have elucidated changes in this angle during defecation.

2) FLUTTER VALVE

It has been suggested that additional protection of continence might be afforded by intraabdominal pressure being transmitted laterally to the side of the anal canal just at the level of the anorectal junction. The anal canal is an anteroposterior slit-like aperture, and any increased intra-abdominal pressure tends to compress it in a fashion similar to a flutter valve ***(31)***.

3) FLAP VALVE THEORY

According to the flap valve theory advanced by Parks et al. ***(32),*** any increase in intra-abdominal pressure (weight lifting, straining, laughing, coughing) tends to accentuate the anorectal angle and force the anterior rectal wall to lie firmly over the upper end of the anal canal, which produces an occlusion or a flap valve effect.

For defecation to occur the flap valve must be broken. This breakage takes place by lengthening the puborectalis, lowering the pelvic floor, and obliterating the angle.

Corpus Cavernosum of Anus

Stelzner ***(33)*** postulated that the vascular architecture in the submucosal and subcutaneous tissues of the anal canal really represents what he called a *corpus cavernosum of the rectum*.

These cushions consist of discrete masses of blood vessels, smoothmuscle fibers, and elastic and connective tissue. They have a remarkably constant configuration and are located in the ***left lateral, right anterolateral, and right posterolateral segments*** of the anal canal. These vascular cushions have the physiologic ability to expand and contract and to take up ‘‘slack,’’ and hence they contribute to the finest degree of anal continence.

This theory might be supported by the fact that certain patients who have undergone a formal haemorrhoidectomy have minor alterations in continence, a situation that may be the result of excision of this corpus cavernosum.

DEFECATION

Usual Sequence of Events

The stimulus for initiating defecation is distention of the rectum. This in turn may be related to a critical threshold of sigmoid and possibly descending colon distention. As long as fecal matter is retained in the descending and sigmoid colon, the rectum remains empty and the individual feels no urge to defecate.

Once begun, the act will follow either of two patterns: (1) expulsion of the rectal contents, accompanied by mass peristalsis of the distal colon, which clears the bowel in one continuous movement, or (2) passage of the stool piecemeal with several bouts of straining. The pattern followed is largely determined by the habit of the individual and the consistency of the feces.

Distention of the left colon initiates peristaltic waves, which propel the fecal mass downward into the rectum. Rectal distention induces relaxation of the internal sphincter, which in turn triggers contraction of the external sphincter. Thus sphincter continence is induced.

A squatting position assumed causes the angulation between the rectum and the anal canal to straighten.

A Valsalva maneuver is the second semi voluntary stage. This overcomes the resistance to the external sphincter by voluntarily increasing the intrathoracic and intra-abdominal pressure. The pelvic floor descends, and the resulting pressure on the fecal mass in the rectum increases intrarectal pressure. Inhibition of the external sphincter permits passage of the fecal bolus. Once evacuation has been completed, the pelvic floor and the anal canal muscles regain their resting activity, and the anal canal is closed.

Surgical Pathology of Haemorrhoids

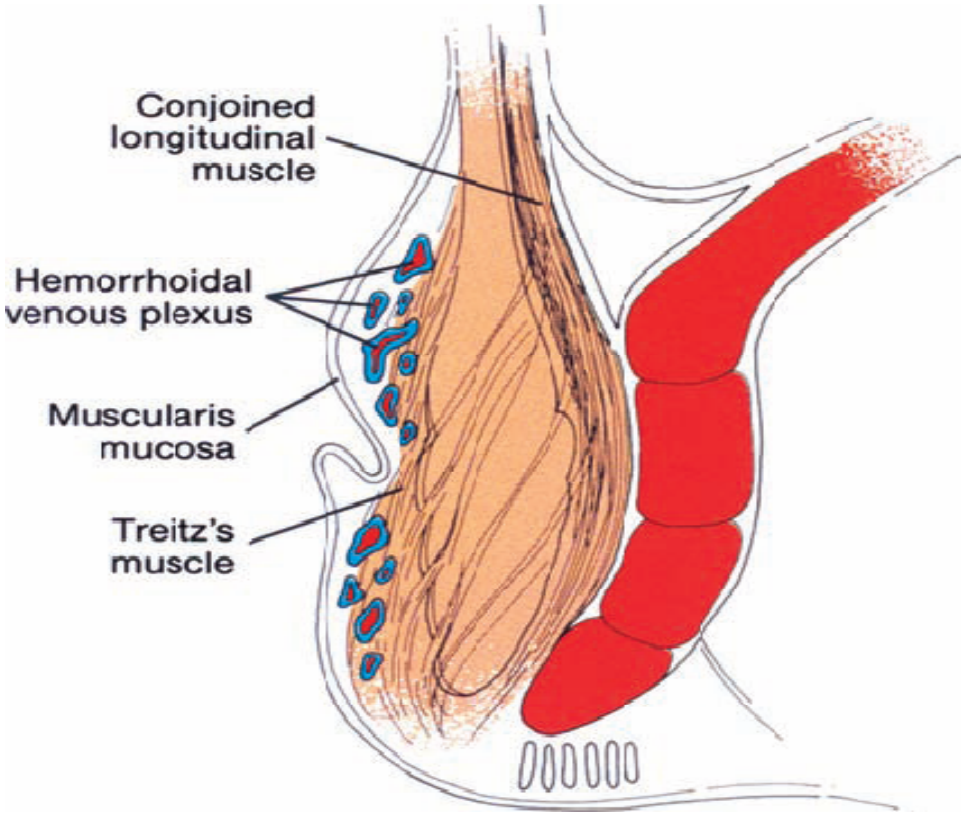
Haemorrhoids are not varicose veins, and not everyone has haemorrhoids. But everybody has anal cushions.

The anal cushions are composed of blood vessels, smooth muscle (Treitz's muscle), and elastic connective tissue in the submucosa (Fig. 9). They are located in the upper anal canal, from the dentate line to the anorectal ring (puborectalis muscle).

Three cushions lie in the following constant sites: ***left lateral, right anterolateral, and right posterolateral.*** Smaller discrete secondary cushions may be present between the main cushions. The configuration is remarkably constant and apparently bears no relationship to the terminal branching of the superior rectal artery, as previously thought ***(17)***.

Return of blood from the anal canal is via two systems: the portal and the systemic. A connection between the two occurs in the region of the dentate line. The submucosal vessels situated above the dentate line constitute the *internal haemorrhoidal plexus* from which blood is drained through the superior rectal veins into the inferior mesenteric vein and subsequently into the portal system.

Elevations in portal venous pressure may manifest as engorgement and gross dilatation of this internal haemorrhoidal plexus. Vessels situated below the dentate line constitute the *external haemorrhoidal plexus* from which blood is drained, in part through the middle rectal veins terminating in the internal iliac veins, but mainly through the inferior rectal veins into the pudendal veins, which are tributaries of the internal iliac veins. The veins constituting this external hemorrhoidal plexus are normally small; however, in situations of straining, because communication exists between internal and external haemorrhoidal plexuses, these veins become engorged with blood. If allowed to persist, this condition can lead to the development of combined internal and external haemorrhoids.



(FIGURE 7) Anal cushion showing Treitz's muscle derived from conjoined longitudinal muscle of the anal canal. *(Gordon, 2007)*

1) INCIDENCE -

To determine to true incidence of haemorrhoids is virtually impossible as many patients go undiagnosed and others may be mis-diagnosed.

The peak incidence is between the ages of 40 -65 yrs, with a decline after 65 yrs.

Although men generally are thought to seek medical help more often than women, there is an equal distribution of haemorrhoidal disease between the sexes ***(34).***

It is found to occur more commonly among the white race, high socio-economic status & those living in rural areas***(35).***

2) ETIOLOGY & PATHOGENESIS -

a) Varicose vein theory - It stems from the assumption that dilatations of the veins of the internal rectal venous plexus result from pathologic change.

This shown as invalid by confirming that the dilatations are in fact normal ***(36)***.

The fact that haemorrhoids are no more common in patients with portal hypertension than in the population at large ***(36,37–39)*** is additional evidence against the theory.

Another fact against the theory is that when anal varices occur as the result of portal hypertension (a rare event), the appearance is quite different from that of haemorrhoids.

This theory also fails to account for the fact that haemorrhoids frequently occur singly and are more common in the right anterior position than elsewhere ***(36)***.

b) Vascular hyperplasia theory - This theory is also obsolete. The histologic study of haemorrhoidectomy specimens by Thomson ***(36)*** showed no sign of vascular hyperplasia, and they were similar to cadaver specimens in which there was no evidence of haemorrhoids.

c) Sliding anal cushions theory - From his detailed anatomic study, Thomson ***(36)*** concluded that a sliding downward of the anal cushions is the correct etiologic theory. Haemorrhoids result from disruption of the anchoring and flattening action of the musculus submucosae ani (Treitz's muscle) and its richly intermingled elastic fibers. Hypertrophy and congestion of the vascular tissue are secondary ***(36).***

Haemorrhoids are associated with straining and with an irregular bowel habit, a feature compatible with the sliding anal lining theory ***(36).*** Hard, bulky stools as well as tenesmus from diarrhea cause straining, which is more likely to push the cushions out of the anal canal. Furthermore, straining may cause engorgement of the cushions

during defecation, making their displacement more likely. Repeated stretching of the submucosal Treitz's muscle causes disruption and results in prolapse ***(36)***.

Haas et al. ***(40)*** and Bernstein ***(37)*** found that the anchoring and supporting connective tissue above the anal cushions had disintegrated and fragmented in patients with haemorrhoids.

3) PREDISPOSING & ASSOCIATED FACTORS -

a) Chronic constipation - has been considered the cause of haemorrhoids.

Gibbons et al. ***(41)*** cast doubt on this hypothesis. Their studies show that patients with haemorrhoids are not necessarily constipated but tend to have abnormal anal pressure profiles and anal compliance. It is well known, however, that constipation aggravates symptoms of haemorrhoids. A case control study on the risk factors for haemorrhoids by Johanson and Sonnenberg ***(42)*** questions the influence of chronic constipation but supports ***diarrhea*** as a potential risk factor. The tenesmus from diarrhea does cause straining.

b) Other factors -

i) ***Heredity, erect posture, absence of valves in the haemorrhoidal plexuses and draining veins, and obstruction of venous return from raised intra-abdominal pressure*** have been implicated in the causation of haemorrhoidal disease.

ii) ***Portal hypertension*** may lead to venous engorgement of the haemorrhoidal plexus and on rare occasions may result in true varices in this area (e.g., in the lower esophagus and retroperitoneum and around the umbilicus).

iii) ***Pregnancy*** undoubtedly aggravates pre-existing disease and, by mechanisms not well understood, predisposes to the development of disease in patients who were previously asymptomatic. Furthermore, such patients usually become asymptomatic after delivery, which suggests that ***hormonal changes, in addition to direct pressure***

effects, may be involved. Straining in an attempt to overcome this problem in many cases will result in the appearance of haemorrhoidal symptoms.

iv) Patients with ***inflammatory bowel disease*** may, in fact, present with true haemorrhoidal symptoms or symptoms suggestive of haemorrhoidal disease. This fact always must be considered in the evaluation of all patients with haemorrhoids.

4) FUNCTIONAL ABNORMALITIES IN HAEMORRHOIDS -

Many studies consistently show ***higher anal resting pressures*** in patients with haemorrhoids ***(43–46)***. An increase in resting pressure is reduced to normal after haemorrhoidectomy.

Internal sphincter, external sphincter, and pressure within the anal cushions can all account for the increased resting tone. However, it is not possible to distinguish their contributions ***(47–49)***.

Patients with enlarged haemorrhoids have been found on electromyography to have increased activity ***(50).***

Another abnormality found in many of these patients is an ***ultraslow pressure wave*** caused by the contraction of the internal sphincter as a whole, but ts significance is not known ***(50).*** Electrical oscillation frequency of the internal sphincter is not abnormal ***(51).***

Anal electrosensitivity and temperature sensation are reduced in patients with haemorrhoids. The greatest change is noted in the proximal anal and mid-anal canals, perhaps because of prolapse of the less-sensitive rectal mucosa. This may also contribute to decreased continence.

5) NOMENCLATURE & CLASSIFICATION -

External skin tags are discrete folds of skin arising from the anal verge. Such tags may be the end result of thrombosed external haemorrhoids or may be a complication of inflammatory bowel disease independent of any haemorrhoidal problem.

External haemorrhoids comprise the dilated vascular plexus that is located below the dentate line and covered by squamous epithelium.

Internal haemorrhoids are the symptomatic, exaggerated, submucosal vascular tissue located above the dentate line and covered by transitional and columnar epithelium.

Internal haemorrhoids can be divided into categories.

Grade 1 - those that bulge into the lumen of the anal canal and may produce painless bleeding.

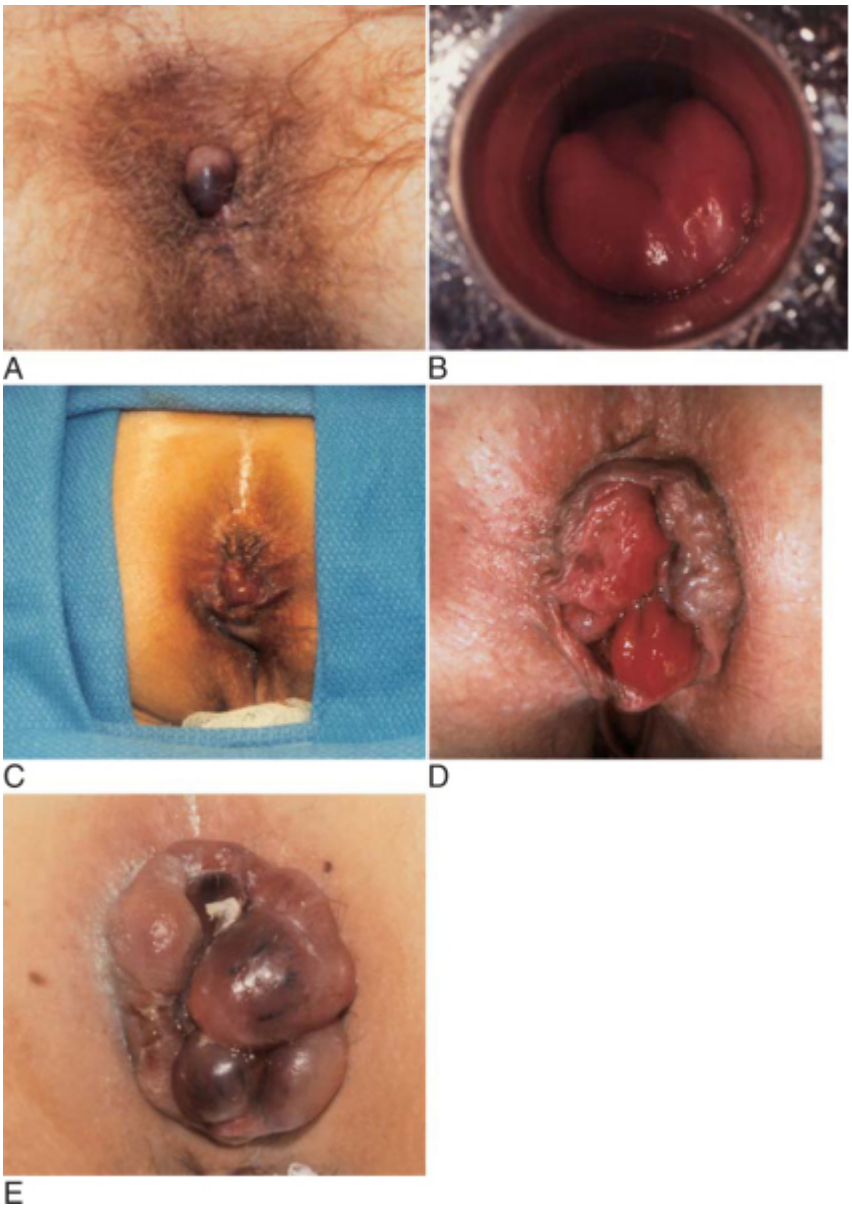
Grade 2 - those that protrude at the time of a bowel movement but reduce spontaneously.

Grade 3 - those that protrude spontaneously or at the time of a bowel movement and require manual replacement.

Grade 4 - those that are permanently prolapsed and irreducible despite attempts at manual replacement ***(52).***

Mixed haemorrhoids are those in which elements of internal and external haemorrhoids are present. Multiple skin tags are often an accompaniment and most frequently occur with external haemorrhoids but may, on less frequent occasions, be associated with internal haemorrhoids.

Strangulated haemorrhoids - Occur in circumstances when the prolapse cannot be reduced because of swelling and spasm of the sphincter, occur. Progression results in gangrenous haemorrhoids.



(FIGURE 8) Hemorrhoids. **A,** Thrombosed external. **B,** First-degree internal viewed through anoscope. **C,** Second-degree internal prolapsed, reduced spontaneously. **D,** Third-degree internal prolapsed, requiring manual reduction. **E,** Fourth-degree strangulated internal and thrombosed external. *(Sabiston textbook of surgery, 18th.Ed)*

6) CLINICAL PRESENTATION -

The common symptoms of haemorrhoids are ***bleeding and prolapse*** . Pain is not a common symptom and if present. ***thrombosis*** is suspected ***(53)***.

EXTERNAL HAEMORRHOIDS

External haemorrhoids are covered with anoderm that is distal to the dentate line. The external haemorrhoids may swell, causing some discomfort. Treatment is not indicated unless there is an acute thrombosis causing severe pain.

INTERNAL HAEMORRHOIDS

In the patient with internal haemorrhoids, several symptoms may be present.

In the classic case, *bleeding is bright red and painless* and occurs at the end of defecation. The patient complains of blood dripping or squirting into the toilet bowl. The bleeding also may be occult, resulting in *anemia*, which is rare, or guaiac-positive stools.

In such instances, other causes of bowel bleeding must be excluded before these problems are attributed to haemorrhoids, even if gross haemorrhoidal disease exists.

Prolapse of the haemorrhoids below the dentate line usually occurs at the time of straining at defecation. In most instances spontaneous reduction occurs. Occasionally, manual replacement is necessary. In some advanced cases the prolapse is irreducible.

Chronic states of prolapse predispose to mucous and fecal leakage, resulting in *pruritus and excoriation* of the perianal skin with accompanying discomfort.

Pain per se is not a symptom of uncomplicated haemorrhoids. It may indicate associated disease, such as *anal fissure, perianal abscess, or, notably, an intersphincteric abscess*. If thrombosis occurs, pain becomes a marked feature of the disease.

Prolapsed, strangulated haemorrhoids present as an acute problem, with the symptom of *pain associated with discharging, edematous, tender, irreducible haemorrhoids*.

Occasionally, when this state of affairs is left untreated for some time, gangrene and infection with sloughing and secondary bleeding occur. Because of the connection with the portal venous system, infection in this area of venous drainage is possible, and pylephlebitis, although exceedingly rare, is a potential complication.

7) EXAMINATION

Examination of patients with suspected internal haemorrhoids should be aimed at several aspects.

General patient assessment - to ascertain the general health status and in particular to exclude associated disease, particularly bleeding disorders and liver disease with portal hypertension, should be the first phase of examination.

Inspection

May reveal variable degrees of perianal skin abnormalities, protrusion of internal haemorrhoids, or normal appearance.

Straining while sitting in the toilet is the most useful examination in patients with grades 2, 3, and 4 haemorrhoids. The severity of the prolapse can be easily seen and the degree of descending perineum can be evaluated.

It can also differentiate haemorrhoid from rectal prolapse particularly when the true rectal prolapse comes to but not through the anus. Asking the patient to strain while the examiner's index finger is in the anorectum, an enterocele can be detected.

Digital examination

To exclude low-lying rectal and anal canal neoplasms and will enable assessment of the tone of the anal sphincter. It should be performed with extreme gentleness using a lubricant, without causing any pain.

Anoscopy

Performed to assess the extent of disease.

With the anoscope in place, the patient is asked to strain as if having a bowel movement so that the amount of prolapse can be assessed. During anoscopy it is also important to look for and rule out a coexisting anal fissure, especially in patients complaining of pain or those in whom anal sphincter tone is deemed excessive.

Proctoscopy or flexible sigmoidoscopy

Must be performed in all cases to visualize the rectum and lower colon so that coexisting conditions may be excluded, in particular, carcinoma, adenoma, and inflammatory bowel disease. The latter condition may produce symptoms similar to haemorrhoidal complaints and may potentiate any haemorrhoids present.

Colonoscopy examination

Should be performed in any patient with unusual symptoms or in whom it is hard to attribute the symptom to the limited degree of confirmed haemorrhoidal disease.

This examination must be undertaken before any treatment is commenced since colonic diseases beyond the range of the sigmoidoscope must be excluded first. Patients who fall into the age or family history category of being at risk for colorectal neoplasms also should have a colonoscopy.

8) **TREATMENT OF HAEMORRHOIDAL DISEASE -**

I) NONOPERATIVE TREATMENT AND MINOR OPERATIVE PROCEDURES

With the modern concepts of the pathophysiology of haemorrhoids, it is believed that prolapse of anal cushions is initiated by the shearing effect of the passage of a large hard stool or by the precipitous act of defecation, such as that in urgent

diarrhea. If the prolapse of the vascular cushions can be prevented or if the congesting effect of a tight anal canal can be abolished, the anal cushions will return to their normal state, and symptoms will be prevented without necessitating the removal of the cushions themselves ***(54).***

a) DIET AND BULK-FORMING AGENTS

The rationale of adding bulk to the diet is to eliminate straining at defecation. Burkitt and Graham-Stewart ***(55)*** observed that stools lacking adequate fiber are small, hard, and difficult to evacuate and thus require prolonged straining.

In addition to consumption of plenty of fruits and vegetables, bulk in the diet can be supplemented easily with raw unprocessed wheat or oat bran (1/3 cup perday). An alternative measure is to take psyllium see(two teaspoons per day). Psyllium seed has been reported in rare cases to cause allergy in some patients ***(56)***. An adequate volume of fluids must be consumed each day. A high-fiber diet reduces symptoms of haemorrhoids and is ideal for the treatment of grade 1 and some grade 2 haemorrhoids ***(57,58).*** It is important to impress on the patient not to ignore the urge to defecate.

OFFICE, OUTPATIENT, AND MINOR PROCEDURES

b) ***Rubber Band Ligation***

Rubber band ligation has proved to be a simple, quick, and effective nonoperative means of treating grades 1 and 2 and selected cases of grades 3 and 4 haemorrhoids ***(60–63)***.

In 1963, Barron ***(59)*** popularized the rubber band ligation of bleeding and prolapsed internal haemorrhoids. Barron reported excellent results in 150 patients; all but seven patients were treated in the outpatient department.

The procedure is performed in the office. An enema or a laxative is not necessary. Sedation is also unnecessary.

Two rubber bands are used on each drum in case one breaks. The procedure

is performed through an anoscope using a rubber band ligator.The bands should be placed on the redundant rectal mucosa at the top of the internal haemorrhoids ***(64,65)***. The external haemorrhoids must be left alone. Traditionally, the ligation is performed at one site at a time. Iyer et al. ***(66)*** reported a retrospective series of 805 patients who underwent a single RBL from grades 1 to 4, with a median follow-up of 3.3 years; many return for subsequent RBL (mean 2, range 1–17) with a median time between bandings of 4.7 weeks.

The success for improvement of symptoms was 70.5%. The success rates were similar for all grades of haemorrhoids although the patients who required the placement of four or more bands was associated with a trend in higher failure rates and greater need for subsequent haemorrhoidectomy.

Complications per treatment series included bleeding (2.8%), thrombosed external hemorrhoids (1.5%), and bacteremia (0.09%). Higher bleeding rates were encountered with the use of aspirin and nonsteroidal anti-inflammatory drugs and warfarin.

Ligations of more than one site in a single session have been practiced by many authors with apparently no higher complications than a single site ***(60,61,67–69).***

The advantage of multiple applications is that it is more cost effective and one may speculate that the requirement for subsequent bandings may be less.

For grades 3 and 4 haemorrhoids, and for patients with deep cheeks of the buttocks, it is preferable to inject the upper anal canal (5mm above the dentate line) with 1.5mL each of 0.25% Bupivacaine containing 1:200,000 epinephrine in four

quadrants instead of injecting the anaesthetic solution into the banded haemorrhoidal tissue as described by Law and Chu ***(69).***

This can be performed without pain and the entire anal canal is completely relaxed giving patients comfort and making the exposure excellent for the procedure.

The key of success in banding severe prolapse is to ligate the redundant rectal mucosa just above the internal hemorrhoids as many sites as required in a single session.

Thomson ***(70)*** concluded that rubber band ligation can be performed in most patients with whatever ‘‘degree’’ of their haemorrhoids and that haemorrhoidectomy is seldom required.

Success rates of RBL vary, depending on the grade of haemorrhoids treated, length of follow-up, and the criteria for success. The reported successes range from 80% to 89%. The recurrences at 4–5 years of follow-up is as high as 68% but symptoms usually respond to repeat ligations; only 10% of such patients require excised haemorrhoidectomy ***(71).***

The most common complication of RBL is pain, which is reported in 5–60% of treated patients ***(71,72).*** *Pain* following the procedure is usually minor and almost always can be satisfactorily managed with warm sitz baths and over-the-counter analgesics. Immediate severe or progressive pain is an indication of a misplaced rubber band ligation—one that is too close to the dentate line and requires immediate removal.

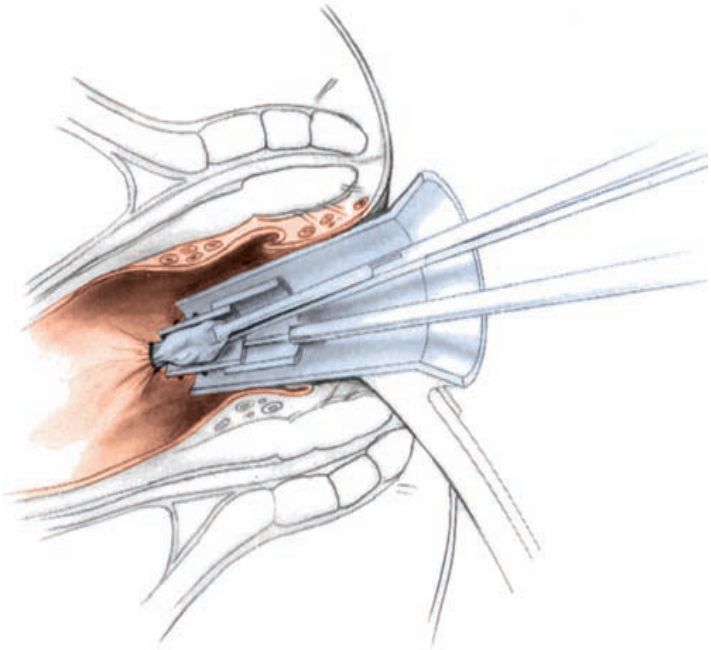
Severe bleeding occasionally requires intervention when the eschar from the band sloughs, usually 1–2 weeks after treatment.

There has been concern about the safety of rubber band ligation because of reports of deaths resulting from acute perianal sepsis ***(73,74).*** The clues to severe anal and

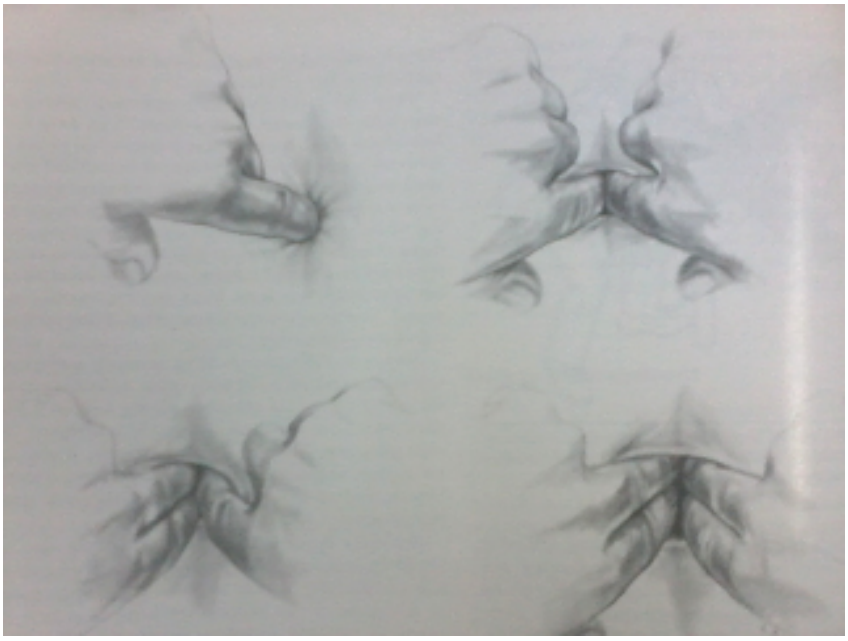
perianal infection after rubber band ligation are a triad of symptoms: delayed anal pain, urinary retention, and fever ***(75).*** Acute awareness of this rare but potentially life-threatening complication is essential, and immediate aggressive treatment is mandatory to prevent death ***(76,77)***.

Treatment should include administration of antibiotics, drainage of an abscess (if present), and excision of necrotic tissues (if present).

Because of possible severe complications, rubber band ligation never should be performed in patients with immunodeficiencies This procedure could be disastrous in those who have tested positive for the human immunodeficiency virus (HIV) ***(78).***



(FIGURE 9)Rubber band ligation. Note banding of rectal mucosa just above the apex of the internal haemorrhoid *(Gordon,2007)*



(FIGURE 10) Maximal Anal Dilation. *(Rob & Smith's Operative Surgery)*

c) ***Infrared Photocoagulation***

The infrared photocoagulator produces infrared radiation (Fig. 12). It coagulates tissue protein or evaporates water in the cells, depending on the intensity and duration of application. The unit has an infrared probe that is applied just proximal to the internal haemorrhoids through an anoscope. The recommendation is to use a duration of 1.5 seconds and repeat three times on each haemorrhoid.

Infrared photocoagulation does not cause tissue necrosis because of the small amount of heat delivered. It is useful to coagulate the friable blood vessels in first-degree haemorrhoids, but it is not effective in the treatment of second- or third-degree haemorrhoids in which tissue destruction is required. Infrared photocoagulation seldom causes pain or other complications ***(79)***. It is not widely used among colon and rectal surgeons.

d) ***Electrocoagulation***

Bipolar (Bicap) coagulation was introduced only recently. This is electrocautery in which heat does not penetrate as deeply as with monopolar electrocoagulation. Its effect is similar to that of infrared photocoagulation, and it is simple to use on an outpatient basis.

Direct current therapy (Ultroit) has been available for several years. The current is applied through a probe placed via an anoscope onto the mucosa at the apex of the haemorrhoid. The current is set to the maximal tolerable level and continued for 10 minutes. Because it is time consuming compared with other simple methods, direct current therapy never has become a popular method.

Both methods can be used to treat first- and second-degree haemorrhoids, but some authors have found them effective for treating third-degree haemorrhoids as well ***(80)***.

The key to success is to coagulate the tops of the internal haemorrhoids until they are charred. The mucosa will be ulcerated as in rubber band ligation and fixed onto the anorectal ring. Because of extensive vascularity, the degree of electrocoagulation must be rather extensive to produce the desired destruction of the submucosa.

e) ***Sclerotherapy***

The rationale of injecting chemical agents into haemorrhoids is to create fibrosis so that prolapse cannot occur. The solutions used are phenol in oil, quinine urea, and sodium morrhuate. The injection must be made into the submucosa above the internal haemorrhoid at the anorectal ring and not intravascularly. Sclerotherapy formerly was the treatment of choice for grades 1 and 2 haemorrhoids, particularly in

the United Kingdom ***(54,58).*** It has gradually decreased in popularity in favour of the more effective electrocoagulation and rubber band ligation.

Sclerotherapy usually produces dull pain, lasting up to 48 hours. Although it rarely occurs, misplacement of the injection can lead to mucosal ulceration and necrosis.

A case of necrotizing fasciitis after injection sclerotherapy for hemorrhoids requiring debridement and defunctioning colostomy has been reported ***(81).***

f) ***Anal Stretch***

In 1968, Lord reported treating haemorrhoids by manual dilatation of the anus. The procedure is based on the belief that haemorrhoids constitute a reversible condition caused by narrowing of the lower anal canal, leading to abnormal straining that causes venous congestion and eventually haemorrhoids. The narrowing is caused by a fibrous deposit that Lord called the ‘‘pecten band.’’ The procedure is performed for grade 3 haemorrhoids. With the patient under intravenous sedation or general anaesthesia, the anal canal is stretched maximally until the bands give way. It is usually necessary to stretch the anal canal and the lower rectum until four fingers from each hand are inserted ***(82).***

An anal dilator is provided for use at home by patients for the next six months to prevent recurrent anal stenosis.

In a trial comparing the results of maximal anal dilatation and haemorrhoidectomy, Lewis et al. ***(83)*** found that maximal anal dilatation has good short-term results, but in the long term some patients develop symptoms that require haemorrhoidectomy.

Maximal anal dilatation is now rarely performed because of concern about anal incontinence and mucosal prolapse. Another disadvantage of maximal anal dilatation is that the associated external haemorrhoids and skin tags are not treated.

g) ***Cryotherapy***

Cryotherapy is based on the concept that freezing at low temperature can destroy the haemorrhoidal tissues. The freezing temperature is achieved by using a special probe through which nitrous oxide at –60 C to –80 C or liquid nitrogen at –196 C is circulated.

A study by Smith et al. ***(84)*** showed that profuse discharge associated with a foul smell and irritation from the necrosis were the rule. The procedure involves pain, and the healing time is very long.

If cryotherapy is not performed properly, destruction of the anal sphincter muscle can cause anal stenosis and incontinence. This technique has fallen into disrepute.

h) ***Lateral Internal Sphincterotomy***

Lateral internal sphincterotomy is used widely for the management of patients with anal fissures in whom the underlying problem is thought to be one of ‘‘hyperfunction’’ of the internal anal sphincter.

Some authorities claim that similar dysfunction accounts for the occurrence of haemorrhoidal diseases ***(85,86).*** Consequently, partial internal sphincterotomy has been advocated to overcome this abnormality.

Sun et al. ***(49)*** dispute this theory. Combined manometric and ultrasonographic studies of the internal anal sphincter, together with a direct measurement of the anal cushions, revealed that the high anal canal pressure in patients with haemorrhoids is due to high pressure of the anal cushions. The thickness of the internal sphincter is not significantly different from the normal subjects.

Unlike maximal anal dilatation, partial internal sphincterotomy has the advantage of precise division of the sphincter under direct vision. This operation can be performed with the patient under local, regional, or general anaesthesia.

Incontinence to varying degrees occurs in 25% of patients and is minor in most instances. Prolapse of redundant mucosa is common and usually requires further treatment. Recurrence of symptoms occurs in only 5% of patients ***(85).***

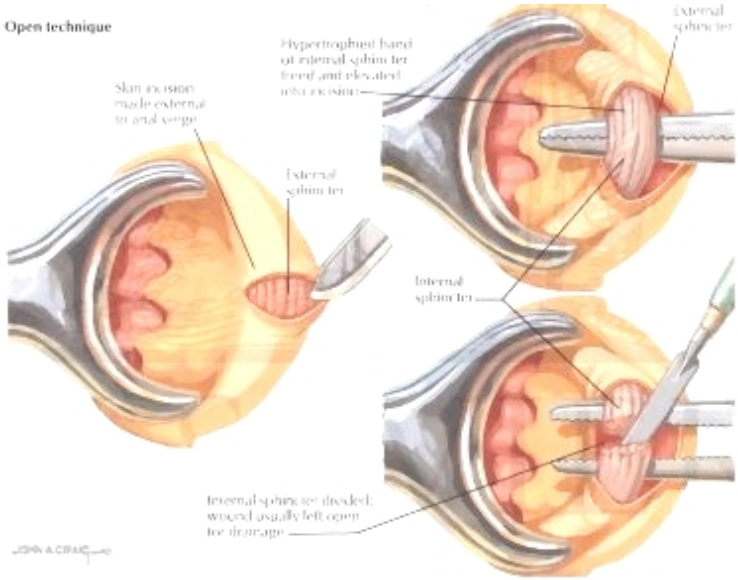
This procedure has no effect on external haemorrhoids and skin tags.

Postoperative care is simple and is aimed at providing patient comfort and ensuring an early bowel movement.

In patients with an anal fissure accompanying haemorrhoids or in patients with evidence of a hyperactive sphincter, partial internal sphincterotomy should be part of the therapy undertaken.

In a series by Schouten and van Vroonhoven ***(86),*** haemorrhoids associated with high anal pressure (>125cmH2O) were treated by a lateral internal sphincterotomy under local anaesthesia on an outpatient basis. Evaluation of the results six months after the operation showed that 78% of patients with grades 1 and 2 haemorrhoids and 65% of patients with grades 3 and 4 haemorrhoids had excellent or satisfactory results.

In spite of the reported excellent results ***(87),*** lateral internal sphincterotomy is not considered a standard treatment for haemorrhoids.



(FIGURE 11) Lateral Internal Sphincterotomy. (*netterimages.com)*

II) HAEMORRHOIDECTOMY

Haemorrhoidectomy should be considered when

(1) haemorrhoids are severely prolapsed and require manual replacement,

(2) patients fail to improve after multiple applications of nonoperative treatments, or

(3) haemorrhoids are complicated by associated pathology, such as ulceration, fissure, fistula, large hypertrophied anal papilla, or extensive skin tags.

The choice of anaesthesia should be individualized. In the majority of cases, haemorrhoidectomy can be performed with the patient under local anaesthesia combined with mild sedation. However, in patients with high cheeks of the buttocks, especially in muscular or obese men, using a general or regional block anaesthetic is preferable ***(88).***

a) CLOSED HEMORRHOIDECTOMY

In 1931, Fansler ***(89)*** described a technique of haemorrhoidectomy in which the dissection was conducted in an anatomic method (intra-anal anatomic dissection). The key to this technique is using the Fansler anal speculum, which is 3 cm in diameter and 7 cm long. The entire haemorrhoidal tissues, along with the redundant skin, can be dissected easily in their normal anatomic location. There is no need to pull the haemorrhoidal pedicle toward the anus for suturing because the exposure is excellent all the way to the apex of the wound. Thus, prolapse of rectal mucosa or ectropion is almost unknown with this technique.

Technique

The procedure is performed with the patient in the prone jack-knife position with the cheeks of the buttocks taped apart. Using Lilly Tonsil scissors (V. Mueller Co., McGaw Park, Illinois, U.S.A.), an elliptical excision is begun at the perianal skin to include external and internal haemorrhoids and is ended at the anorectal ring.

During the excision, the scissors is pressed firmly on the anal wall. This technique allows excision of a full thickness of mucosa and submucosa without injury to the underlying internal sphincter muscle. The strip of the excision should not be wider than 1.5 cm. Since it is easy to inadvertently cut too high, the top of the internal haemorrhoid should be marked with electrocautery.

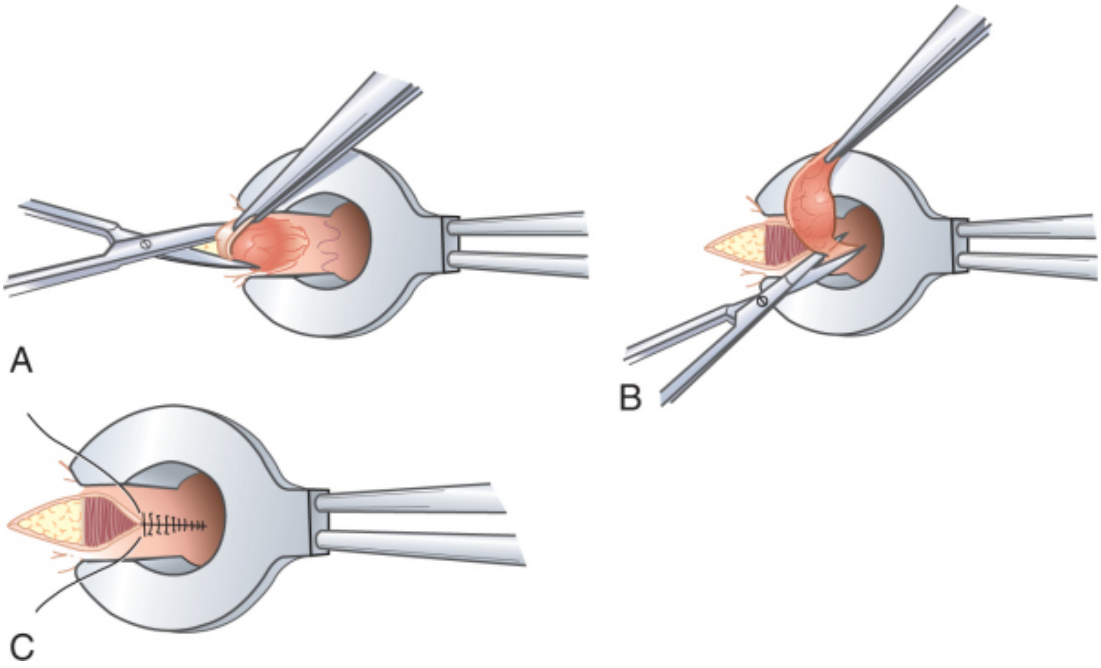
Unless there is an associated anal stenosis or an anal fissure, internal sphincterotomy is not performed. The entire wound is closed with a running 3–0 chromic catgut suture or a rapid absorbable synthetic suture, 2mm apart. It is important to use a three-point stitch at the apex of the wound to avoid a mass effect, which can cause a tenesmus. If too much tissue has been excised, the wound should be marsupialized and left open. The largest and most redundant haemorrhoid should be excised first.

With this approach, the original plan to excise three quadrants may be modified so that only a two-quadrant haemorrhoidectomy is necessary. It is believed that some anal cushion should be preserved to maintain good anal continence ***(90),*** particularly when patients approach the fifth and sixth decades of life.

Ideally, the haemorrhoidectomy excision should not be performed in the posterior commissure unless plastic flap procedures are planned, because in this location the wound heals slowly and has a greater tendency to form a fissure.

Ideally, all excised tissues should be labeled properly and submitted separately for microscopic examination. Rarely, unsuspected malignancy or inflammatory bowel disease may be so diagnosed.

Cataldo and MacKeigan ***(91)*** reported only one instance of unsuspected anal carcinoma out of 21,257 haemorrhoidectomies. No further treatment is required for the incidental carcinoma found in an excised specimen provided the rest of the anal canal has no high grade and intraepithelial neoplasia ***(92).***



(FIGURE 12) Closed haemorrhoidectomy.

A, Hemorrhoidal tissues are sharply excised starting just beyond the external component and working proximally, finishing with resection of the internal component.

B, The sphincter muscles are preserved by dissecting only the tissues superficial to them.

C, The pedicle is transfixed and the defect closed with a running absorbable suture.

(Sabiston textbook of surgery, 18th Ed).

b) CLASSICAL MILLIGAN-MORGAN HAEMORRHOIDECTOMY

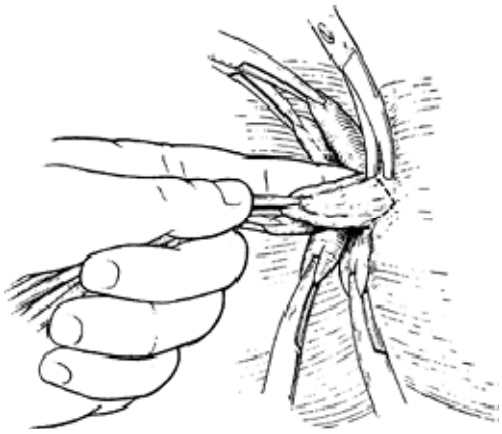
The procedure known as excision and ligation, also called open haemorrhoidectomy, was originated by Frederick Salmon, the founder of St. Mark's Hospital, London, in the 1830s ***(93).***

Milligan et al. popularized and modified the technique, which is widely used in the United Kingdom as well as throughout the world ***(94–96).***

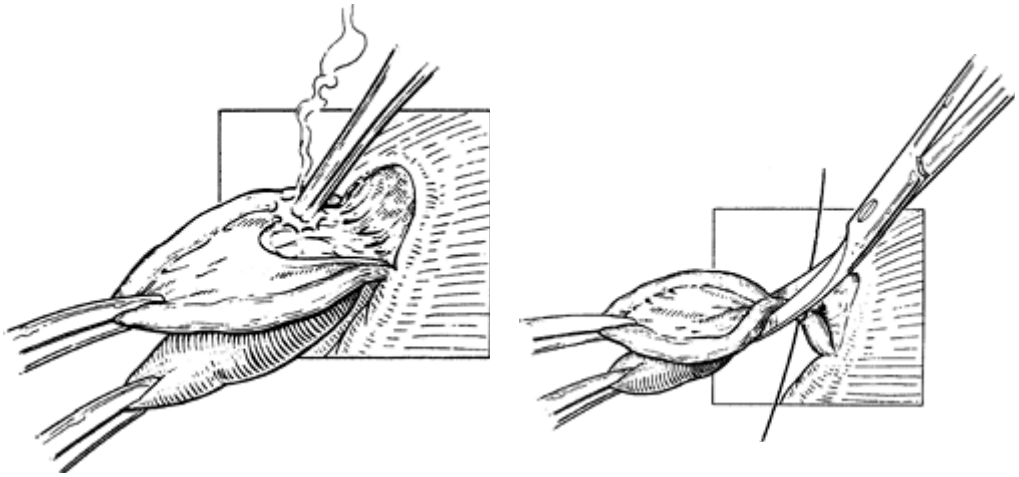
Technique - The procedure is performed with the patient in the lithotomy position. The anal canal is gently dilated with two fingers, and forceps are placed on the

perianal skin just outside the mucocutaneous junction at each primary haemorrhoid. As the internal haemorrhoids are pulled down, a second forceps is put onto the main bulk of each haemorrhoidal mass, producing the ‘‘triangle of exposure.’’ The haemorrhoid is excised from the underlying sphincter muscle.

The dissection is carried out proximally as far as the pedicles,where it is stick-tied with 3–0 chromic catgut. The rest of the wound is left open, and a light dressing is applied to the wound. Other haemorrhoids are treated in a similar manner.



(FIGURE 13) A V-shaped incision is made over the anoderm at the base of the haemorrhoid. *(Mastery of Surgery, 5th Ed.)*



(FIGURE 14) Diathermy and dissection of the fibers of the muscularis submucosa ani. *(Mastery of Surgery, 5th Ed.)*

c) MODIFIED WHITEHEAD HAEMORRHOIDECTOMY

In 1882, Whitehead ***(97)*** of Manchester, England, described a technique for haemorrhoidectomy. A circular incision was made at the level of the dentate line. The submucosal and subdermal haemorrhoidal tissues then were dissected out. The redundant rectal mucosa was excised and sutured to the anoderm.

Although Whitehead called this operation simple, Allingham ***(93)*** thought that the operation was rather difficult to perform properly; it was bloody, and the patient was prone to stricture, loss of sensation, and development of ectropion.

The technique soon fell out of favor in the United Kingdom, but it has attracted the attention of some surgeons in the United States, where it has been revived with some modifications ***(98,99)***.

Technique

The procedure for the modified Whitehead hemorrhoidectomy is performed with the patient in the prone position. Exposure of the anal canal is by the Buie self-retaining anal retractor. An incision is made at the level of the dentate line in one quadrant, and a flap of anoderm is raised. The submucosal and subdermal haemorrhoidal plexuses are excised, and the redundant rectal mucosa is excised transversely.

The flap of anoderm is advanced proximally and sutured to the rectal mucosa. Haemorrhoids in other quadrants are removed in a similar manner. The key to the success of this modified technique is suturing the flap of anoderm to the mucosa in the upper anal canal rather than pulling the mucosa down to the anoderm at the dentate line.

In a long-term follow-up of 484 patients in the series reported by Wolff and Culp ***(99),*** there were no recurrences or ectropions. The cited advantage of this operation is for treatment of extensive circumferential haemorrhoids.

d) LASER HAEMORRHOIDECTOMY

Laser therapy has been used with success in some patients for the treatment of polyps and rectal carcinomas, although its indications and necessity are quite limited. Laser also has been used for performing haemorrhoidectomy, but reports in the literature are extremely limited.

Yu and Eddy ***(100)*** reported excellent success with Nd:YAG laser hemorrhoidectomy performed in 134 patients. The procedure was performed on an outpatient basis.

Iwagaki et al. ***(101)*** reported on 1816 patients who underwent CO2 laser haemorrhoidectomy with excellent results. These were not controlled studies and are difficult to compare with conventional haemorrhoidectomy.

Senagore et al. ***(102)*** conducted a randomized study of the results using the Nd:YAG laser versus a scalpel in the treatment of third- and fourth-degree haemorrhoids, using the closed Ferguson haemorrhoidectomy. The study involved 51 and 35 patients treated with the laser or a scalpel, respectively.

The two groups were similar with respect to hospital stay, requirements for parenteral and oral analgesics, as well as time off work. There was a greater degree of wound inflammation and dehiscence at the 10-day postoperative visit for the laser group ($p<0.05$). The use of the laser was also more expensive.

A prospective study by Leff ***(103)*** included 170 patients and 56 patients who underwent a closed haemorrhoidectomy using a CO2 laser or a scalpel, respectively. Outpatient surgery was performed in 72% of the cases studied. There was no difference in postoperative pain, wound healing, and postoperative complications such as urinary retention, bleeding, and fecal impaction in the two groups studied. At

one time, the public demand for laser haemorrhoidectomy was great because of hearsay and rumors that laser haemorrhoidectomy resulted in less pain and produced better results than conventional haemorrhoidectomy. To date, there has been no documentation for such claims.

e) STAPLED HAEMORRHOIDOPEXY

This is a new and innovative procedure to treat the prolapsed haemorrhoids. Although stapled haemorrhoidectomy is the most popular term, it is literally incorrect since the haemorrhoids are not removed. Other terms that appear in the literature are: stapled anopexy, stapled haemorrhoidopexy, circumferential mucosectomy, rectal prolapsectomy, circular haemorrhoidectomy, circumferential stapled anoplasty, stapled rectalmucosectomy.

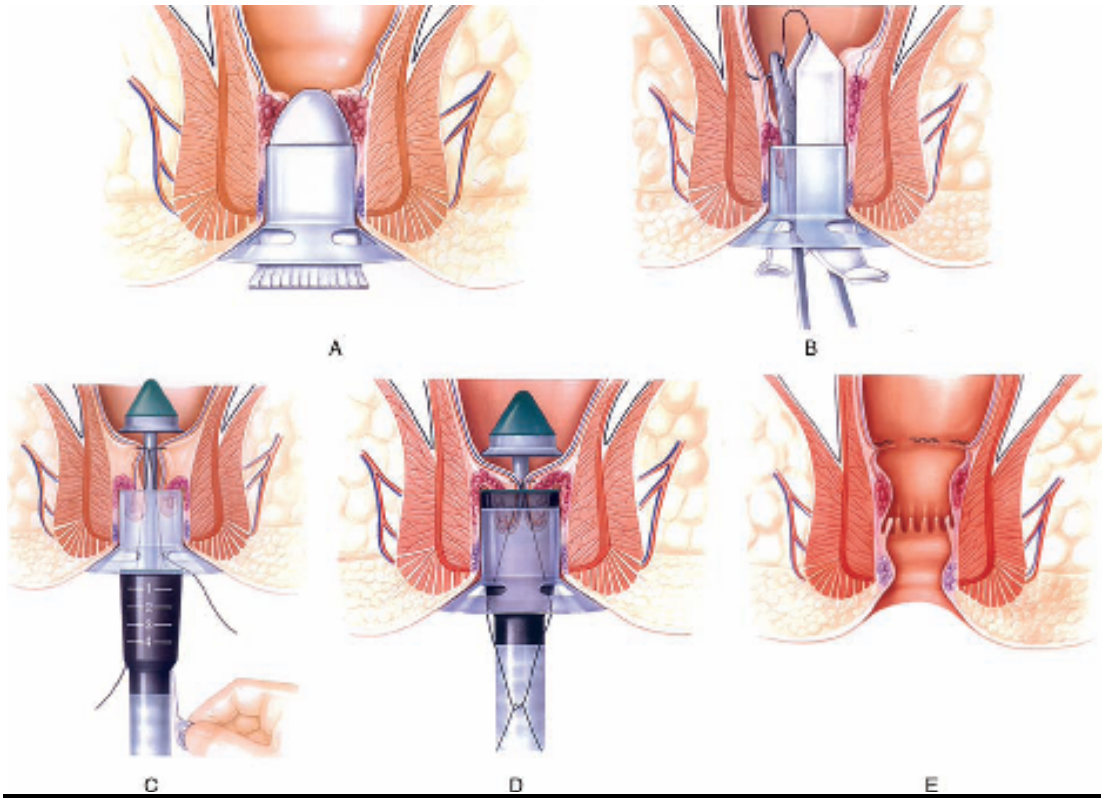
An international working party experienced in performance of the haemorrhoid operation using circular staple was convened in Missillac, France, in July 2001. The expert panel came up with the term stapled haemorrhoidopexy ***(104).***

The procedure is based on the concept that haemorrhoids occur because of the downward protrusion of the anal cushions resulting from the redundant and loose lower rectal mucosa and that the internal haemorrhoids themselves are histologically normal ***(36).***

The goal to this procedure is, in fact, not different from rubber band ligation in which the redundant rectal mucosa at the top of the internal haemorrhoid is ligated. Stapled haemorrhoidopexy resects a much larger redundant rectal mucosa and should be performed only in severe grade 3 or 4 haemorrhoids in which multiple rubber band ligations are not suitable.

In 1990, G. Allegra of the University of Florence, Italy, first used a stapler for haemorrhoidal surgery. The submucosal purse-string was placed at the level of the dentate line and the entire haemorrhoids were excised. This technique was subsequently abandoned, in favor of a higher placed purse-string above the internal haemorrhoids ***(105).***

It was Antonio Longo ***(106)*** of the University of Palermo, Italy, who popularized the technique of excising the redundant lower rectal mucosa using a circular stapler for the treatment of patients with prolapsed haemorrhoids. Longo's techniques and results were presented to the World Congress of Endoscopic Surgery in Rome, 1998.



(FIGURE 15)
(A) The anal dilator is inserted into the anal canal and secured to perianal skin with heavy sutures.
(B) The purse-string suture anoscope is introduced into the anal dilator for placement of a purse-string of 2–0 Prolene in the submucosa, 4–5 cm above the dentate line.
(C) The haemorrhoidal circular stapler is opened to its maximum position. Its head is introduced and positioned proximal to the purse-string, which is then tied over the shaft of the anvil. With the help of the suture threader (crochet hook), the ends of the suture are pulled through the lateral holes of the stapler.
(D) The ends of the suture are knotted externally. At this point, the entire casing of the stapler is introduced into the anal canal. The stapler is then closed and fired.
(E) At completion, the staple line should be about 2cm above the top of the internal haemorrhoids.
(Gordon, 2007)

4. METHODOLOGY

A prospective study was done on 100 hospitalized patients at the Coimbatore Medical College Hospital during the period between June 2010 - October 2011.

All patients presented with Grade 2 , 3 and 4 haemorrhoids were examined in detail to rule out other lower gastrointestinal pathologies.

All patients were operated upon using the Milligan-Morgan haemorrhoidectomy.

Patient selection was based on the Inclusion and Exclusion criteria as given below.

Patients to be subjected to ***Lateral Internal sphincterotomy or Maximal Anal Dilatation*** were randomly selected and were divided into two groups - ***Group A and Group B*** respectively.

INCLUSION CRITERIA -

-Recurrent bleeding

- Mucous prolapse

- Continuous or recurrent pruritis

- Sense of heaviness, tenesmus

EXCLUSION CRITERIA -

- Haemorrhoidal recurrence

- Anal fissure

- Polypoidal lesions

- Perianal fistula

- Perianal abscess

- Patients with bleeding tendencies

- Patients refusing to participate in the study

Methods :

1. Clinical history and Physical examination :

A complete history with regards to the patients' chief complaints was obtained from all patients. A detailed physical examination was performed, with emphasis on Digital per rectal examination and proctoscopy in order to establish a diagnosis.

2. Pre-operative Investigations :

A written informed consent was obtained from all patients. The following Investigations were carried out pre-operatively on all patients-

-Complete Blood Count

-Blood Urea, Random blood sugar

-Serum creatinine

-Liver function Test / Coagulation Profile

-Plain Chest X Ray

-ECG

-Ultrasonography of the abdomen & pelvis

3. Pre-operative Preparation :

All patients were kept on Overnight starvation, the day before the surgery. The perineum, lower abdomen, thighs and back were shaved.

A saline enema was given on the night before the surgery and on the morning of the operation.

4. Operation :

MILLIGAN-MORGAN HAEMORRHOIDECTOMY -

Spinal anaesthesia was given to all the patients. Patients were placed in the Lithotomy postion. The perineum was painted and draped. The patients were placed

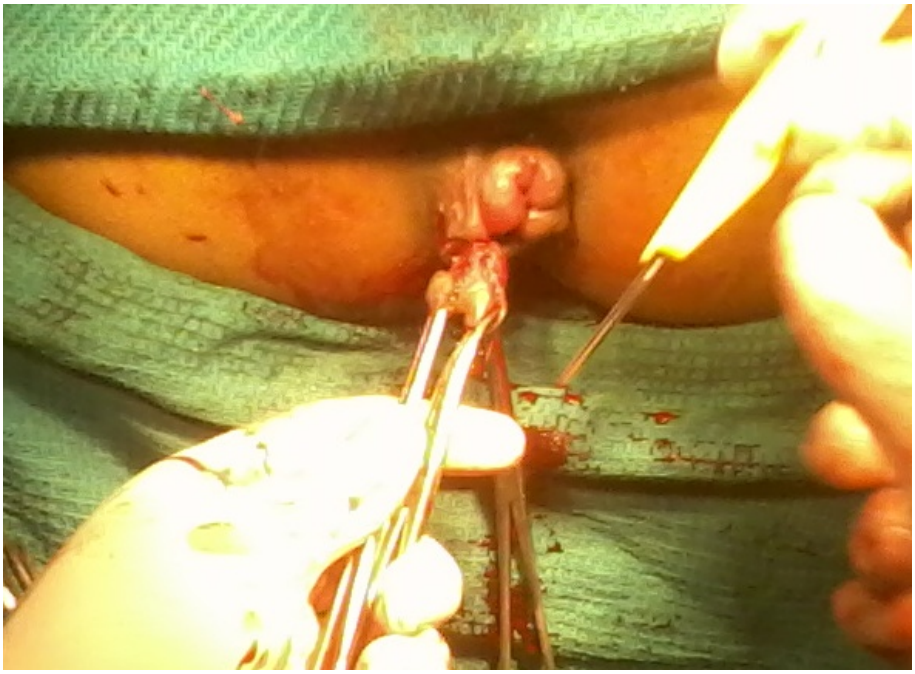
with the feet in stirrups, and the anal canal gently dilated. A proctoscope was inserted to identify the site of the three principal haemorrhoids. Tissue forceps were then applied to each pile and to the skin adjacent to the haemorrhoid.

The procedure was started with the 7 o'clock haemorrhoid, followed by the 3 o'clock haemorrhoid, and finished with the 11 o'clock haemorrhoid, so that the operation field was not obscured by bleeding. The tissue forceps holding the haemorrhoid and its adjacent skin was grasped in the left hand. A V shaped incision was made in the surrounding perianal skin with scissors. The cut was deepened toward the anal canal to reveal the lower fibers of the internal anal sphincter. The sphincter was gently swept away with tissue forceps from the haemorrhoid. The scissors were then used to excise the haemorrhoidal tissue within the anal canal, which left the apex of the haemorrhoid with its arterial supply and venous drainage intact for ligature. The pedicle of each haemorrhoid was then enclosed in an arterial clip, and the pedicle was transfixed using nonabsorbable suture material. Haemostasis was then secured from the bed of the haemorrhoid by use of cautery. Only then was the pedicle ligated. The ligature was left long so that if any further bleeding occured, the pedicle could be easily identified and delivered into the operative field. Each haemorrhoid was dealt with in the same manner; however, well-established skin bridges between each V-shaped segment of excised skin was maintained.

The patients were then subjected to a LIS or a MAD as per their randomly allotted group.

PICTURE 1 - GRADE 3 HAEMORRHOIDS

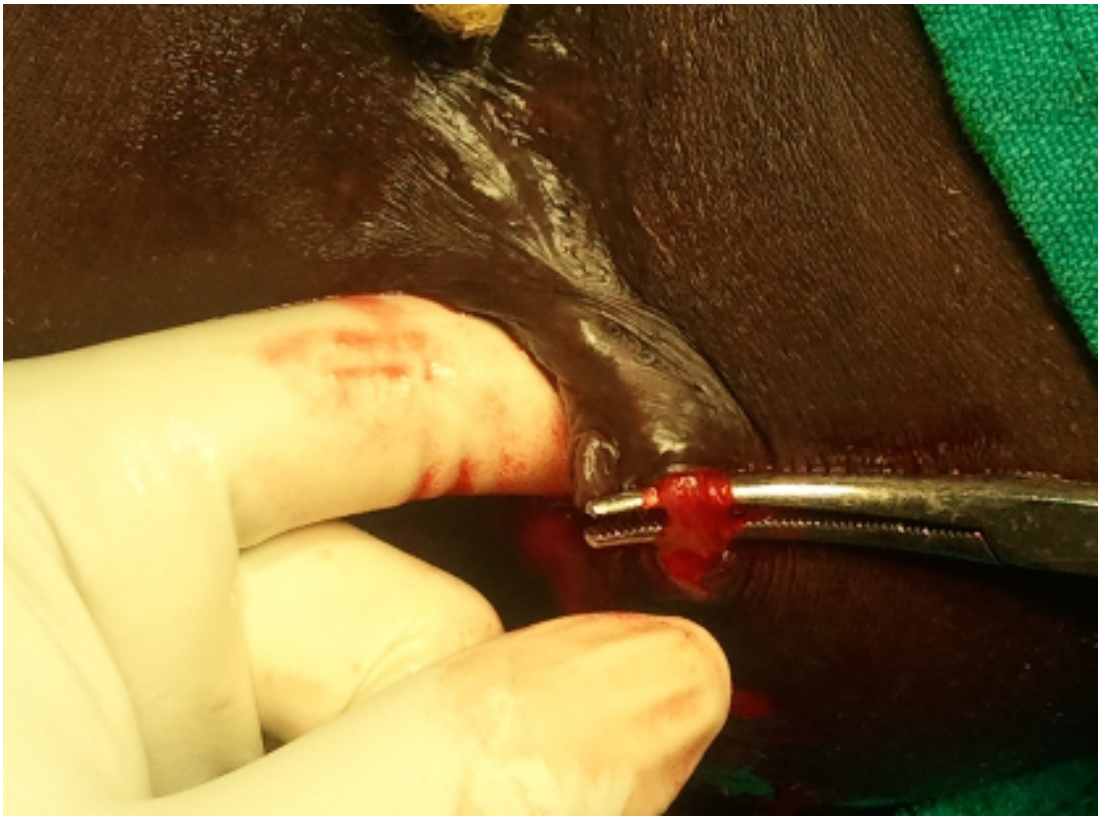
PICTURE 2 - CLASSICAL MMH



LATERAL INTERNAL SPHINCTEROTOMY (Open technique) - (Group A)

An anal speculum was inserted to expose the lateral aspect of the anal canal. A transverse incision was made just outside the anal canal at the 3 o clock position for ca length of approximately 1.0 to 1.5 cm. By blunt dissection, the fibres of the external sphincter were separated to develop the intersphincteric plane so that there was no damage to the external sphincter. Once the white fibers of the internal sphincter had been clearly separated from other structures, the internal sphincter was divided with scissors.

PICTURE 3 - LATERAL INTERNAL SPHINCTEROTOMY



MAXIMAL ANAL DILATATION - (Group B)

With the patient under spinal anaesthesia, the anal canal was stretched maximally using four fingers until the bands gave way, till the anal canal permitted all four fingers, informing the anaesthetist.

At the end of the operation, an anal speculum was inserted to be absolutely certain that there was complete haemostasis. Gauze dressings were then applied to each haemorrhoidal area.

PICTURE 4 - MAXIMAL ANAL DILATION

PICTURE 5 - MAXIMAL ANAL DILATION

5. Post-operative care :

Both groups of patients were encouraged to resume oral feeding after 6 hours post-operatively. Non opiod analgesics were given to all patients.

Pain was assessed using a Visual Analog Scale (VAS). Pain was considered as severe when VAS >5.

Visual Analog Scale	Characteristic
0	No pain
5	Moderate pain
10	Severe agonizing pain

Data concerning the 2 groups were then compared.

A close observation on post-operative complications such as bleeding, urinary retention was made. Lactulose 20ml once daily was started on the 2nd postoperative day and continued for 2 weeks.

Patients were advised to take sitz baths thrice a day for 3days, lots of fluids and High fibre diet.

6. Discharge :

Patients were allowed to go home when fully comfortable on oral analgesics, fully mobile and tolerating normal diet.

7. Follow up :

Patients were followed up on Outpatient basis after one week from the date of discharge to assess complications like anal incontinence, anal stenosis and persistent pain.

8. Analysis : The data collected was tabulated, calculated, evaluated and analyzed using Fisher's exact test.

5. RESULTS

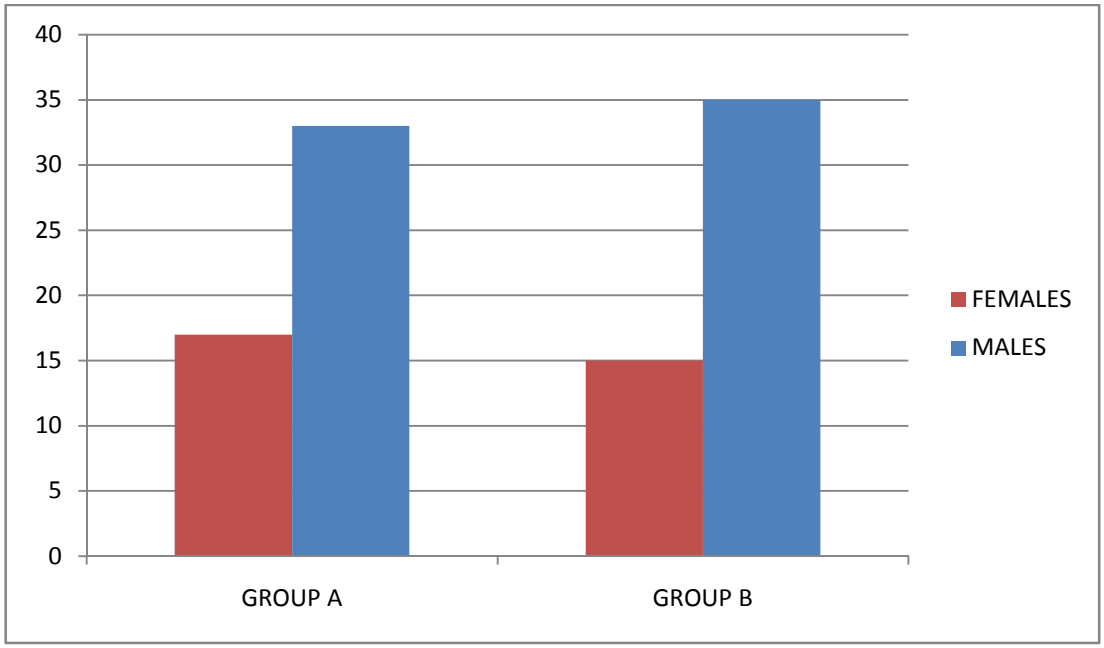
This study included 100 patients with Grades 2, 3 and 4 haemorrhoids. All patients underwent a MMH. A total of 50 patients were randomized to receive LIS (Group A) and the remaining 50 patients were subjected to a MAD (Group B).

Distribution of sex is shown in Table 1 and Figure 16.

TABLE 1 : Sex Distribution of patients in Groups A and B.

	LIS (GROUP A) 50 patients	MAD(GROUP B) 50 patients	TOTAL
MALES (%)	33(48.5%)	35(51.5%)	68
FEMALES (%)	17(53%)	15(47%)	32

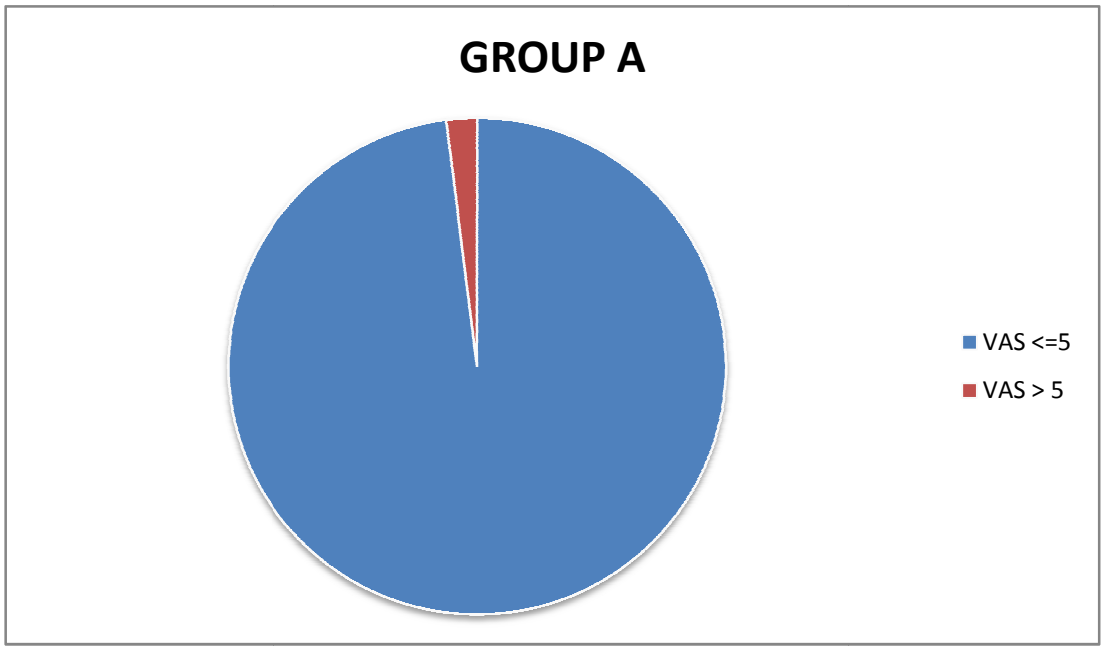
The distribution of males and females were comparable in both groups.



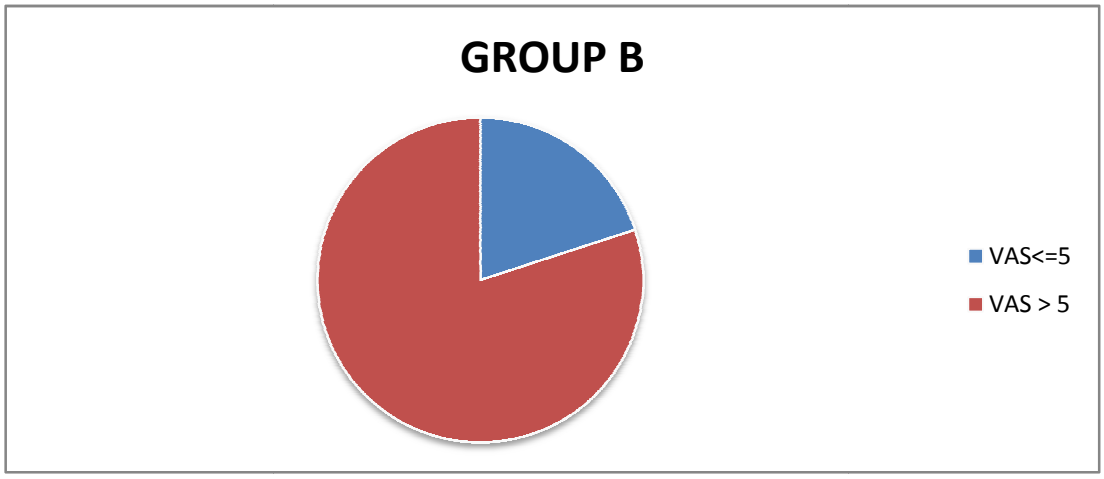
(FIGURE 16) - sex distribution

TABLE 2 : Post operative pain in the 2 groups.

	LIS (GROUP A) (%)	MAD (GROUP B) (%)
Visual Analog Scale <=5	49 (98%)	10 (20%)
Visual Analog Scale > 5	1 (2%)	40(80%)



(FIGURE 17) Postoperative pain in GROUP A



(FIGURE 18) Postoperative pain in GROUP B

Table 2 and Figures(17,18) show the comparison of post-operative pain between Groups A and B.

By using Fisher's exact test, p value was found to be less than 0.0001 which is extremely statistically significant. ($p < 0.0001$)

Of the 50 patients who underwent LIS, 98% experienced mild to moderate pain on the 1st and 2nd post-operative days. These patients needed analgesics only on the 1st post-operative day.

Only 2% of the patients in Group A, experienced severe pain and were treated with analgesics for 3 days post-operatively.

Among the 50 patients who underwent MAD, 80% experienced severe pain which lasted for atleast 3days. These patients were given analgesics for 3 or more days. Only 20% of the patients in Group B experienced mild to moderate pain.

From the above tables and figures, it becomes clear that the occurrence of severe post-operative pain is comprehensively reduced when performing a LIS rather than a MAD after a MMH.

6. DISCUSSION

Haemorrhoids are one of the most frequent anorectal disorders encountered in the primary health care setting. They are the most common cause of bleeding per rectum and cause considerable patient discomfort and disability ***(107)***.

Inspite of the many newer techniques to treat haemorrhoids, such as, Harmonic scalpel, Ligasure, Stapled haemorrhoidopexy, today, the Milligan-Morgan Haemorrhoidectomy is still one of the most popular surgical treatments of haemorrhoids.

Among the complications of haemorrhoidectomy, severe pain is the most frequently occurring one, as shown by many studies ***(108).***

Anal canal dilatation was described by Lord in 1989***(109)***. which was based on a careful and firm dilatation of the anal canal. This reduced the pressure in the anal canal and hence treating the haemorrhoids and any associated pain ***(109).***

Internal sphincterotomy was suggested by Notaras in 1971***(109).*** Di Bella and Estienne in 1990 suggested that internal sphincterotomy removed pain by reduction of sphincter tonicity***(109).***

In this respect, it is worth considering the importance of performing a LIS/MAD after a MMH to prevent postoperative pain and comparing the two as highlighted in many multi-centric trials***(108).***

The present study demonstrated that severe post-operative pain was considerably lesser in the LIS Group A (2%) than MAD Group B (80%).

The LIS is a more controlled procedure when compared to the MAD. The patients in Group A were much more comfortable in the post-operative period when compared with those patients in Group B. Group A patients were started on oral diet much

earlier, and required lesser doses of analgesics. The duration of hospital stay was also reduced in the Group A patients who returned to normal activity much earlier. The results of this study in these aspects are in concurrence with those reported by *Galizia .G et al, (2000)* ***(110)*** and *Giuseppe Diana et al, (2009)* ***(108).***

7. CONCLUSION

A comparative study was undertaken to evaluate the post-operative pain after a MMH with LIS in one group versus MAD an another group.

2 groups of patients, 50 in each participated in this study. The distribution of sex was comparable in both the groups.

Post-operative evaluation revealed -

Significant reduction in the pain when a LIS is performed when compared to MAD. ($p < 0.0001$)

The in-hospital stay and return to work was also found to be sooner in those patients who underwent a LIS.

Haemorrhoids is one of the most common anorectal disorders seen in a primary health care set up. As it is cost-effective, the Milligan-Morgan haemorrhoidectomy is still one of the most commonly performed procedures to treat haemorrhoids, when compared to the newer techniques.

Post-operative pain however, is one of the most common complications after the procedure.

In this study, it was found that when a LIS was performed, pain was reduced greatly when compared with those patients who underwent a MAD.

It is thus recommended that, when a MMH is performed to treat haemorrhoidal disease, it should be accompanied by a LIS in order to reduce post-operative pain, and that, this combination of procedures can be standardised as a surgical treatment option for haemorrhoidal disease.

Therefore, this study confirms the previous studies done by scientists from other countries that, haemorrhoidectomy along with lateral internal sphincterotomy definitely reduces the post operative pain ***(108-110).***

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APPENDIX I - PROFORMA

Name : DOA:

Age/Sex:

Occupation:

Address:

Chief complaints :

1. Bleeding: duration, amount, colour.
2. Pain: duration, nature, association with defecation.
3. Mass per anum(reducible spontaneously or manually).
4. Discharge of pus or mucous.
5. Abnormality of bowel habit, pruritus.
6. Risk factor: constipation, difficulty in passing urine.

Past history :

H/O previous surgery

H/O Diabetes Mellitus/Systemic HyperTension/asthma/epilepsy/TB

Personal history :

Diet, Sleep. Bowel/Bladder, smoker/alcoholic.

GENERAL PHYSICAL EXAMINATION :

1. Obese/not obese
2. Nutritional status : poor/average/good
3. Pallor
4. Icterus
5. Cyanosis/Clubbing/pedal edema
6. Generalized/Regional lymphadenopathy

7. Pulse rate/Blood pressure

SYSTEMIC EXAMINATION :

Per rectal examination :

Inspection - anal tags, sentinel pile, mass(position)

Digital Examination - rectal wall, lumen, prostate.

Proctoscopy - internal pile mass(1st,2nd,3rd degrees)

Per Abdomen :

To rule out any mass, organomegaly, free fluid.

Respiratory system :

To rule out any chest infections.

Cardiovascular :

To rule out any cardiac anomalies.

Diagnosis :

Investigations -

Complete blood count, Urea, Creatinine, RBS.

LFT/CT/BT/PT

Chest X ray, ECG.

USG Abdomen & pelvis.

Management :

Pre operative treatment : correction of anaemia, treatment of respiratory infection.

Operative procedure : Type of surgery, anaesthesia, prophylacticantibiotic.

Post operative period : pain, bleeding, urinary retention.

Follow up : occurrence of fistulas, perianal abscess, anal incontinence.

NAME	AGE	SEX	IP No.	D.O.A	D.O.S	D.O.D	GRADE	PROCEDURE	POST OP PAIN(Visual Analog Scale)
VENNILLA	28	F	36275	6/17/2010	6/21/2010	6/24/2010	GRADE 3	MAD	6
SATHIYAPANA	40	F	39242	7/1/2010	7/6/2010	7/8/2010	GRADE 3	LIS	4
KALA	34	F	40460	7/7/2010	7/8/2010	7/9/2010	GRADE 3	MAD	5
GUNASUNDARI	40	F	42153	7/15/2010	7/20/2010	7/22/2010	GRADE 2	LIS	3
CHANDRAN	36	M	43071	7/20/2010	7/23/2010	7/25/2010	GRADE 3	MAD	7
VENKATESH	31	M	43265	7/21/2010	7/24/2010	7/26/2010	GRADE 3	LIS	2
RANGADURAI	20	M	45229	7/29/2010	8/14/2010	8/16/2010	GRADE 3	MAD	8
SAROJINI	43	F	46524	8/5/2010	8/14/2010	8/16/2010	GRADE 3	LIS	3
VARATHARAJAN	48	M	47479	8/10/2010	8/13/2010	8/15/2010	GRADE 2	MAD	6
VIJAYALAKSHMI	40	F	47722	8/11/2010	8/14/2010	8/16/2010	GRADE 3	LIS	5
AMSAVENI	26	F	48134	8/13/2010	8/16/2010	8/18/2010	GRADE 3	MAD	6
PERIYASAMY	60	M	50101	8/24/2010	8/27/2010	8/29/2010	GRADE 3	LIS	2
SANTHANAM	41	M	51739	9/1/2010	9/3/2010	9/5/2010	GRADE 3	MAD	6
THANGAM	30	M	52967	9/7/2010	9/10/2010	9/12/2010	GRADE 2	LIS	3
BADIRIGIRI	21	M	52924	9/7/2010	9/10/2010	9/12/2010	GRADE 3	MAD	5
DEVENDRAN	35	M	53132	9/8/2010	9/18/2010	9/20/2010	GRADE 3	LIS	2
SENTHIL	37	M	54437	9/15/2010	9/18/2010	9/20/2010	GRADE 3	MAD	7
RASATHI	30	F	54703	9/16/2010	9/21/2010	9/24/2010	GRADE 3	LIS	4
KOLARCHINNAN	43	M	56995	9/27/2010	10/1/2010	10/3/2010	GRADE 2	LIS	3
MAHAMUTHU	42	F	62690	10/20/2010	10/26/2010	10/28/2010	GRADE 3	LIS	3
SRINIVASAN	55	M	63795	10/24/2010	10/27/2010	10/29/2010	GRADE 3	MAD	6
MOHAN	47	M	69425	11/24/2010	11/27/2010	11/29/2010	GRADE 3	LIS	4
MUTHULAKSHMI	37	F	69631	11/25/2010	11/29/2010	12/1/2010	GRADE 3	LIS	4
SHANTHI	39	F	20802	12/2/2010	12/4/2010	12/6/2010	GRADE 3	LIS	3

GOMATHI	60	F	73160	12/14/2010	12/16/2010	12/19/2010	GRADE 3	MAD	6
PALANISAMY	40	M	73112	12/15/2010	12/18/2010	12/20/2010	GRADE 3	LIS	3
SANMUGAM	48	M	73352	12/15/2010	12/25/2010	12/27/2010	GRADE 3	MAD	7
MANJULA	38	F	1016	1/6/2011	1/12/2011	1/14/2011	GRADE 3	MAD	5
RAJAGOPAL	50	M	2042	1/10/2011	1/12/2011	1/14/2011	GRADE 3	MAD	5
KASTHURI	19	F	4549	1/25/2011	1/27/2011	1/29/2011	GRADE 2	MAD	6
SAMYNABNAN	53	M	7019	2/7/2011	2/9/2011	2/11/2011	GRADE 3	LIS	3
PALANISAMY	44	M	7268	2/7/2011	2/9/2011	2/11/2011	GRADE 3	LIS	4
ARUMUGAM	57	M	7271	2/7/2011	2/9/2011	2/11/2011	GRADE 3	MAD	6
JEYAKUMAR	41	M	7621	2/9/2011	2/20/2011	2/22/2011	GRADE 3	LIS	4
CHELLAMMAL	65	F	7687	2/10/2011	2/15/2011	2/17/2011	GRADE 3	MAD	6
DHANALAKSHMI	45	F	9084	2/17/2011	3/1/2011	3/3/2011	GRADE 3	MAD	6
NAGARAJ	36	M	8659	2/18/2011	2/20/2011	2/22/2011	GRADE 3	MAD	5
SHEELAVATHY	35	F	11206	2/28/2011	3/2/2011	3/4/2011	GRADE 3	LIS	3
MURUGAN	43	M	12448	3/4/2011	3/11/2011	3/13/2011	GRADE 3	LIS	3
SURESH KUMAR	34	M	12492	3/4/2011	3/11/2011	3/13/2011	GRADE 3	MAD	6
RANGASAMY	54	M	11950	3/4/2011	3/8/2011	3/10/2011	GRADE 3	MAD	7
MURUGAN	40	M	12686	3/5/2011	3/7/2011	3/9/2011	GRADE 3	LIS	2
PANNERSELVAM	55	M	14675	3/16/2011	3/18/2011	3/20/2011	GRADE 3	LIS	6
MURUGAN	43	M	15057	3/20/2011	3/25/2011	3/27/2011	GRADE 3	LIS	4
RANGASAMY	54	M	15772	3/21/2011	3/24/2011	3/26/2011	GRADE 3	MAD	4
SIDDHICK	35	M	16021	3/23/2011	3/26/2011	3/28/2011	GRADE 3	LIS	2
SATHYAMOORTHY	62	M	16034	3/23/2011	3/26/2011	3/28/2011	GRADE 3	MAD	6
DHANALAKSHMI	40	F	18412	4/3/2011	4/6/2011	4/8/2011	GRADE 3	LIS	2
SHANMUGAM	50	M	19097	4/6/2011	4/8/2011	4/11/2011	GRADE 3	LIS	5
KESAVAN	39	M	19750	4/7/2011	4/10/2011	4/13/2011	GRADE 3	MAD	7
RAJENDRAN	51	M	21872	4/18/2011	4/20/2011	4/22/2011	GRADE 3	MAD	6

RANI	42	F	19554	4/21/2011	4/23/2011	4/25/2011	GRADE 3	LIS	3
NAGALAKSHMI	40	F	24905	5/3/2011	5/6/2011	5/8/2011	GRADE 3	LIS	3
SARAVANA KUMAR	34	M	24595	5/3/2011	5/5/2011	5/7/2011	GRADE 3	LIS	3
RATHINAMMAL	72	F	23737	5/3/2011	5/15/2011	5/17/2011	GRADE 3	MAD	5
KARUNANITHI	41	M	24581	5/3/2011	5/5/2011	5/7/2011	GRADE 3	MAD	6
KANDHASAMY	38	M	26749	5/11/2011	6/3/2011	6/7/2011	GRADE 3	MAD	6
SUBRAMANIAM	50	M	23948	5/12/2011	5/14/2011	5/16/2011	GRADE 3	LIS	5
DHARMARAJ	28	M	26878	5/12/2011	5/14/2011	5/16/2011	GRADE 3	MAD	6
LAKSHMI	32	F	27534	5/16/2011	5/20/2011	5/21/2011	GRADE 3	LIS	3
SANGARALINGAM	41	M	28282	5/19/2011	5/23/2011	5/25/2011	GRADE 3	MAD	6
SAMBATH KUMAR	32	M	28280	5/20/2011	5/22/2011	5/23/2011	GRADE 3	LIS	2
KANNAN	25	M	29764	5/25/2011	5/27/2011	6/1/2011	GRADE 3	LIS	3
SIVACHANDRAN	30	M	30506	5/30/2011	6/2/2011	6/3/2011	GRADE 3	LIS	2
THARUMENDRAN	32	M	30526	5/30/2011	5/31/2011	6/1/2011	GRADE 3	MAD	6
KALPANA	30	F	30738	5/31/2011	5/31/2011	6/1/2011	GRADE 3	MAD	5
BAZEER	45	M	32578	6/8/2011	6/10/2011	6/13/2011	GRADE 2	LIS	3
GOPAL	60	M	32597	6/8/2011	6/13/2011	6/16/2011	GRADE 3	MAD	5
SARAVANA KUMAR	33	M	34173	6/11/2011	6/13/2011	6/16/2011	GRADE 3	MAD	6
JEYALAKSHMI	38	F	33701	6/14/2011	6/17/2011	6/19/2011	GRADE 3	LIS	3
KUPPUTHAI	50	F	35144	6/21/2011	6/24/2011	6/26/2011	GRADE 3	MAD	7
KALIYAMMAL	55	F	35532	6/23/2011	6/26/2011	9/28/2011	GRADE 3	MAD	6
RAJENDHRAN	65	M	36555	6/28/2011	7/2/2011	7/4/2011	GRADE 3	LIS	4
RAJ	40	M	38284	7/2/2011	7/4/2011	7/6/2011	GRADE 3	LIS	2
SITHURAMAN	45	M	37943	7/5/2011	7/18/2011	7/20/2011	GRADE 3	MAD	6
RAHAMATULLA	23	M	40645	7/18/2011	7/20/2011	7/22/2011	GRADE 3	MAD	6
ARUMUGAM	50	M	40631	7/18/2011	7/20/2011	7/22/2011	GRADE 3	MAD	6
SANTHOSH	74	M	40829	7/19/2011	7/23/2011	7/25/2011	GRADE 2	LIS	3

PAULRAJ	44	M	40842	7/19/2011	7/23/2011	7/24/2011	GRADE 2	LIS	4
PARAMESWARI	30	F	40898	7/19/2011	7/23/2011	7/25/2011	GRADE 3	LIS	5
GOTHANDARAM	57	M	40833	7/19/2011	7/23/2011	7/25/2011	GRADE 3	MAD	7
BALAN	62	M	42014	7/25/2011	7/28/2011	7/30/2011	GRADE 3	LIS	3
MEENA	43	F	42039	7/25/2011	7/29/2011	7/31/2011	GRADE 3	LIS	4
GOWRI	45	F	42256	7/26/2011	7/29/2011	8/1/2011	GRADE 3	MAD	6
AMMASAI	40	M	42791	7/27/2011	7/29/2011	7/31/2011	GRADE 2	MAD	6
SEKAR	40	M	42806	7/29/2011	8/3/2011	8/5/2011	GRADE 3	LIS	3
ALAGAPPAN	75	M	44239	8/5/2011	8/6/2011	8/7/2011	GRADE 2	LIS	2
NATARAJAN	65	M	44869	8/9/2011	8/11/2011	8/13/2011	GRADE 3	MAD	6
NEELAVATHY	36	F	47869	8/24/2011	8/29/2011	8/31/2011	GRADE 2	LIS	2
KANJANA	20	F	47878	8/24/2011	8/26/2011	8/28/2011	GRADE 3	MAD	6
VELUSAMY	56	M	48812	8/29/2011	9/2/2011	9/4/2011	GRADE 2	MAD	6
THIRUMOORTHY	36	M	50807	9/8/2011	9/10/2011	9/12/2011	GRADE 3	MAD	6
SURESH	32	M	51755	9/13/2011	9/17/2011	9/19/2011	GRADE 2	LIS	2
KANAGARAJ	38	M	52255	9/15/2011	9/17/2011	9/19/2011	GRADE 2	LIS	3
RAJAN	41	M	52919	9/19/2011	9/21/2011	9/23/2011	GRADE 3	LIS	4
MARUDASALAM	48	M	53386	9/21/2011	9/26/2011	9/28/2011	GRADE 2	LIS	5
MANI	43	M	53613	9/22/2011	9/24/2011	9/26/2011	GRADE 3	MAD	6
MADHAVI	29	F	58265	10/11/2011	10/13/2011	10/15/2011	GRADE 3	MAD	6
JAMESHA	35	M	58257	10/11/2011	10/13/2011	10/15/2011	GRADE 3	MAD	7
SRINIVASAN	52	M	58567	10/12/2011	10/14/2011	10/16/2011	GRADE 3	MAD	5